ComboPlus™

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Guide to Installation & Operation

AST RESEARCH INC.

User's Manual
Rev. 5

MC Series

64KB - 256KB Memory ComboPlus Card

for the

I.B.M. Personal Computer

AST RESEARCH INC.
2372 Morse Avenue, Irvine, California 92647
(714) 540-1333

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1.0 Introducing the ComboPlus

The AST **ComboPlus**™ is a versatile and powerful memory expansion and data I/O accessory for your IBM Personal Computer (PC). Its many optional features (including a real-time clock), allow you to tailor a ComboPlus to suit your system's size and applications.

Depending on the options selected, the ComboPlus supplies up to 256KB (kilobytes) of additional Random Access Memory (RAM). With this larger storage capacity you can run any PC compatible applications software requiring additional memory, and expand the capacity of some of your existing programs, such as spreadsheet models.

As a bonus, AST Research gives you two valuable utility programs: **SuperDrive**™, a disk emulation program allowing you to use part of your memory as a superfast "electronic diskdrive"; and **SuperSpool**™, an intelligent print spooler allowing you to output files to a printer without tying up your PC.

Your ComboPlus board is available with 64, 128, 192, or 256 Kilobytes of RAM memory. If you prefer, you can start off small and install an AST memory upgrade kit as you need more space.

Available Features:

*Up to 256K of expansion memory. (You decide how much you need.)

*A battery back-up real time clock so that you don't have to re-enter the time and date every time you start your system. The battery power is only used when your system is turned off (optional).

*An RS-232C serial interface to be used for a MODEM, printer, CRT, or other serial device (optional). (Note: a current loop teletype interface is not supported.)

*A parallel printer port to be used for connecting a parallel printer to the PC (optional).

1.1 "Do I Really Need to Read This Manual?"

If you are familiar with the memory and I/O capabilities the ComboPlus provides, and you have a 64K PC system with no current I/O options (other than the printer port on an IBM Monochrome Adapter), all you have to do is set the PC system switches for the amount of memory your system will have with your ComboPlus installed and you're set to go. However, AST strongly recommends that you thumb through this manual at your leisure, and read up on the SuperPak software utilities.

If you have other I/O capability in your present system, you may want to scan the appropriate chapters of this manual. This might save you some headaches later on. If you have problems, you should certainly go back and read the appropriate chapter for

some helpful hints, and to clarify the conditions necessary for your memory and/or I/O option to function properly.

NOTE: BE SURE TO FILL OUT YOUR WARRANTY CARD AND MAIL IT IN.

1.2 System Requirements

You need 64K bytes of RAM on your PC system board prior to installing any expansion memory cards.

If you are not certain how much memory you have, insert a DOS diskette in drive A and type:

CHKDSK<ENTER>

The second line from the bottom of your display will indicate the number of bytes of total memory. You should have at least 65536 bytes before installing your ComboPlus.

If you do not have at least 64K, you must upgrade your system board prior to installing the ComboPlus. Your dealer can advise you as to how this can best be done.

2.0 Getting Started

Before you start disconnecting cables, removing the cover and all that, please take the time to read this manual. Doing so will get you acquainted with the simple procedures you will follow to properly install you ComboPlus. If you have a working PC at hand, you may want to create a new working DOS diskette and copy the SuperPak utility files to it. (See the COPY command in your DOS manual for instructions.) This will save you some time when you initialize the optional Clock-Calendar, SuperDrive, or SuperSpool later on. If you wish to wait and copy these command files later on, that's fine too.

2.1 ComboPlus Memory Switch Settings

Your **ComboPlus** card is extremely versatile and is fully compatible with the IBM PC. To simplify installation, AST has pre-configured the card so many customers can just plug it in and put it to work. This factory setting is called the "default configuration".

If your system meets the default configuration, then there is nothing to adjust on the ComboPlus card. HOWEVER, you do have to adjust a switch on the IBM PC system board, so the PC will be aware of the additional memory added by the installation of your ComboPlus.

If your system varies from the default configuration, this manual explains how to adjust the ComboPlus card so that it is compatible with your current set-up.

A Word About Setting Switches

The switch components on the ComboPlus and on your IBM PC system board contain eight toggle or rocker switches, numbered 1 through 8, with ON and OFF marked on the switch housing.

The toggle type switches are very straightforward and can be manipulated with your fingernail or a pen. To set one of the eight switch positions to "ON", simply slide the switch in the direction indicated on the component housing.

The rocker type switches perform the same function as the toggle switch. A pen can be used to adjust a toggle switch. To set one of the eight positions to "ON", simply push down the "ON" side of the rocker switch with a pen.

2.2 The Default Configuration

The ComboPlus is factory pre-configured for the following system:

***64K bytes of RAM on the system board.**
***and no additional memory boards.**

If your IBM PC is as described above, there is no need to adjust the switch on the ComboPlus board.

Just to verify that the eight settings are correct, please look at the switch (SW1 in Diagram A) located near the bottom of the ComboPlus card. The switch positions should be set as follows:

```
ComboPlus Switch 1 (SW1) Position
**********************************
*  1   2   3  4   5   6   7   8  *
* ON  ON  ON OFF OFF OFF OFF OFF *
**********************************
```

<u>This is the default switch setting regardless of the amount of memory on your ComboPlus!</u>

Summary of Function for
Switch S1 on Your ComboPlus Board

```
Switch Position

1 2 3 4 5 6 7 8
| | | | | | | |
| | | | | | | |--    parity disable (ON to disable)
| | | | | | |
| | | | | | |----
| | | | | |------    memory bank disable (ON to disable)
| | | | |--------
| | | |
| | | |----------
| | |------------
| |--------------    starting memory address (see 2.5)
|----------------
```

Switches 1 through 4 are used to select the starting location of your ComboPlus board's memory. (See 2.5.)

Switches 5, 6, and 7 may be used to disable the first, second, and third 64K ComboPlus memory banks, respectively. (See Diagram A.)

Switch 8 may be used to disable the parity check of the ComboPlus board's memory. (Applies only to Revision D and subsequent revisions.)

If your system matches the default conditions, and the switch positions are set correctly, proceed directly to the section entitled "Removing The PC System Unit Cover".

2.3 IBM PC System Memory Map

The diagram below depicts your PC's system memory map. The number on the left represents one of the sixteen possible 64K blocks of memory in the PC.

Your **ComboPlus** board's memory can be placed to start on any one of these blocks, except "0", "A", "B" and "F" which are reserved for use by the operating system and the IBM Display Adapter. See the section on memory settings later in this chapter for more details.

PC Memory Structure

```
High Memory              ---------------------------------------
                              system ROM
                F(0000)  ---------------------------------------
                              expansion memory
                E(0000)  ---------------------------------------
                              expansion memory
                D(0000)  ---------------------------------------
                              expansion memory
                C(0000)  ---------------------------------------
Each of the                   graphic buffer
16 blocks       B(0000)  ---------------------------------------
of memory                     graphic buffer
is 64K in       A(0000)  ---------------------------------------
size.                         expansion memory
                9(0000)  ---------------------------------------
                              expansion memory
                8(0000)  ---------------------------------------
                              expansion memory
                7(0000)  ---------------------------------------
                              expansion memory
                6(0000)  ---------------------------------------
                              expansion memory
                5(0000)  ---------------------------------------
                              expansion memory
                4(0000)  ---------------------------------------
                              expansion memory
                3(0000)  ---------------------------------------
                              expansion memory
                2(0000)  ---------------------------------------
                              expansion memory    (default location)
                1(0000)  ---------------------------------------
Low Memory                    system board 64K memory block
                0(0000)  ---------------------------------------
```

2.4 Position of Memory

If the ComboPlus card is your only memory expansion card, you do not need to read this section. You may skip ahead to the section entitled, "Removing the PC System Unit Cover".

The position of the memory on the ComboPlus can be configured to be **BELOW** (in front of) or **ABOVE** (after) the memory contained on most other memory cards in your PC. On most systems, all the other memory is **BELOW** the memory on the ComboPlus. The ComboPlus card can be configured and placed on any 64K byte address boundary within the one megabyte PC addressing. If the other memory card in your system is an IBM 64K memory expansion card (this is not the 64K of memory on your system board); or, if it is a memory card(s) whose memory expansion sockets are completely installed with RAMs, then this other memory card is definitely **BELOW** the memory on your ComboPlus. That way, if you add additional memory to the ComboPlus (assuming it is not already configured with 256K), you do not have to adjust switches on any memory card since the amount of memory **BELOW** the ComboPlus will not change. On the other hand, if your ComboPlus is fully loaded, **and** if you have another memory card that is **not** fully loaded, **or**, if you have an IBM version **32K** system board, you will have to place the other memory **ABOVE** the memory of the ComboPlus. (This is because the PC power-up diagnostics do not allow holes [gaps] in RAM memory.)

Consult your other memory card's user manual for how to adjust its switch settings to place its memory **ABOVE** that of the ComboPlus.

No change in switch settings is required on the ComboPlus. You should, however, verify that the switch settings are in the default configuration. (See 2.2 above.)

2.5 If You Have Additional Memory Boards

This section applies only to users who are using the ComboPlus in conjunction with one or more additional memory cards. There is no need to read this section if your total memory, before installing the ComboPlus card, is 64K bytes.

If you have another memory card in addition to the ComboPlus card, you must adjust the switches on one or both of the cards. The table below illustrates the switch settings of a ComboPlus card which is configured to be **ABOVE** the memory contained on other memory card(s) in your PC. On most systems, all the other memory is **BELOW** of the memory on the ComboPlus card.

This arrangement may save you the steps of having to physically remove the other memory card from the chassis and adjust the switch settings. See section above entitled "Position Of Memory."

The table below shows the proper switch settings for the **ComboPlus** when other memory cards are already installed. **The memory size to the left of the table is the total amount of memory onboard the PC <u>before</u> the ComboPlus is installed.**

Memory installed **BELOW** your ComboPlus card:

Switch #1 on ComboPlus (SW1)

use c̄ IBM PC

wrong - X

	Switch Position								
	1	2	3	4	5	6	7	8	
64K	**ON**	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**Factory Setting**
128K	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	
192K	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	
256K	ON	OFF	ON	ON	OFF	OFF	OFF	~~OFF~~ ON	
320K	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	
384K	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	
448K	ON	OFF	OFF	OFF	OFF	ON	ON	OFF	
512K	OFF	ON	ON	ON	ON	ON	ON	OFF	

For other memory address settings, please consult the factory.

2.6 Removing the PC System Unit Cover

It takes only a few minutes to remove the cover from the PC, and install the **ComboPlus** card into one of the empty slots in your PC's system board. This manual has all the necessary instructions. Instructions for removing the cover and setting the switches on your system board are also contained in your IBM Personal Computer Guide to Operations.

CAUTION: Be sure that the power switch is off and the plug is removed from the system unit. Turn off the printer or any other equipment connected to the computer. Installing any component while the power is on can permanently damage your computer and its components.

1. Looking at the system unit from the rear, notice the two mounting screws at the lower corners of the back panel. Remove the screws, using a flathead screwdriver or a hex wrench.

2. Slide the system unit cover towards the front. When the cover will go no further, carefully tilt it upwards and remove it from the system.

2.7 Setting the Switches on the IBM PC System Board

This section refers to the switches on the PC's system board, **not those on the ComboPlus card.** There are two eight-position switches, labeled SW1 and SW2. SW2 is right by the corner of the power supply compartment; SW1 is in the same row of components, further towards the expansion slots.

Setting switch #1:

Switch #1, positions 3 and 4, should be in the OFF position. While the cover is removed, you can select the number of SuperDrives using positions 7 and 8; refer to the section entitled "SuperDrive PC System Preparation Guide" in the SUPERDRIVE/SUPERSPOOL USER'S MANUAL for instructions. The other positions of switch #1 are unrelated to memory size and are left unchanged.

Switch #1 on the PC System Board

Total No. of disk drives including "SuperDrives"	Switch Position 1	2	3	4	5	6	7	8
2	*	*	OFF	OFF	*	*	OFF	ON
3	*	*	OFF	OFF	*	*	ON	OFF
4	*	*	OFF	OFF	*	*	OFF	OFF

* left unchanged

Setting switch #2:

This switch adjusts for the size of the **total system program memory**. That includes the 64K on your system board, the memory on the ComboPlus, and that of any other memory card. Set the switch positions according to this guide.

Switch #2 on the PC System Board

Total System Memory	Switch Position 1	2	3	4
128K	ON	OFF	ON	ON
160K*	OFF	OFF	ON	ON
192K	ON	ON	OFF	ON
224K*	OFF	ON	OFF	ON
256K	ON	OFF	OFF	ON
288K*	OFF	OFF	OFF	ON
320K	ON	ON	ON	OFF
352K*	OFF	ON	ON	OFF
384K	ON	OFF	ON	OFF
416K*	OFF	OFF	ON	OFF
448K	ON	ON	OFF	OFF
480K*	OFF	ON	OFF	OFF
512K	ON	OFF	OFF	OFF
544K*	OFF	OFF	OFF	OFF

(*) settings for total system memory with an IBM 32K memory card installed. Note that this memory card must be placed above that of your ComboPlus. See 2.4 and 2.5 above.

Your system is now properly adjusted for the total amount of memory resident in your PC.

NOTE: The settings for switch 2 on the PC system board only allow for 544K of memory. (This is a limitation of the PC, which can actually utilize up to 832K of RAM depending on system configuration.) If you have more than 544K memory installed in your system, these switches should be set to the 544K positions (switches 1-4, all OFF).

Certain programs read these switches to determine the size of system memory. **Memory in excess of 544K can be addressed by software which does not read the system switches to determine memory size. This includes your SuperDrive and SuperSpool utilities. Many software vendors have become aware of this problem and are revising their software accordingly.**

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3.0 Serial Asynchronous Communication (Option S)

This section applies to a ComboPlus board equipped with the Serial Communication **(S)** option. This is not to be confused with the parallel option, discussed in the next section. If your ComboPlus card does not include this option, you can add it yourself (see User Upgrade Information).

The serial port is also known as an async (asynchronous) port, or RS-232C interface. Its purpose is to handle non-synchronous serial data transmission between your PC and a MODEM, a serial printer, or other serial device. This is a two-way communications link. Data transmissions "across" the link take place in a serial fashion (one bit after another). Multiple wires are installed between either end of the communications link. Your PC serial port and the port on the remote serial device use these wires to signal one another. This allows data transmissions in either direction to be controlled properly.

(NOTE: an extensive discussion on wiring RS-232 interfaces is presented in Appendix F.)

Your serial port has a DB25P (plug or male type) connector (Diagram A: J1) that extends through the mounting bracket of your ComboPlus card.

If your present system has no serial port, the ComboPlus "S" option is ready for use as shipped.

The IBM PC allows up to two serial communication ports, (called **COM1** and **COM2**). Your ComboPlus serial port can be set up as either **COM1** or **COM2**. **COM1** is the default (factory) setting. PC DOS recognizes COM1 and COM2 as serial communication lines.

To use a communications line you must make sure the asynchronous communications parameters (baud rate, parity, databits, and stopbits) are properly set. This is done using the MODE command under PC DOS or the OPEN command under BASICA. Consult the appropriate manual for details. Your ComboPlus' serial port is fully compatible with the parameter ranges specified by the MODE or OPEN command (baud rate, parity, databits and stopbits). Don't be intimidated by these technical terms. You do not need to know the ins and outs of data communication to properly set up your serial port. All you need to do is use the MODE or OPEN command to match the parameters of your COM line to those of the remote device. Often, the remote device also has setable parameters. Consult your manual or dealer for the best match of parameter settings.

If you change devices, be sure and change your COM line parameter settings accordingly.

If the serial port on your ComboPlus is to be the only serial port in your system, there is no need to alter any of the settings on the ComboPlus. You may skip ahead to the section entitled "Configuring Your Application Software". If, however, you already have a serial port in your system, you must make several simple changes to the jumpers on your ComboPlus board.

3.1 Reconfiguring Your ComboPlus Serial Port

This discussion applies only to systems with more than one serial port, in which the currently installed port is COM1.

There are two sets of "jumpers" that must be moved to change your ComboPlus' serial port from **COM1** to **COM2.** (Jumpers are pairs of wire pins, that are connected or "jumped" with small, plastic-coated blocks to complete an electrical circuit.) The process is quick and easy, and can be performed without special tools.

Moving the First Jumper

Place your ComboPlus card so that the black mounting bracket is towards the right, and find the plastic jumper blocks about one inch to the left of the mounting bracket, midway between the top and bottom edges of the card. There are four sets of pins. These are paired vertically. We are concerned only with the jumper that is furthest to the right. Immediately above that jumper is the designation C1. That stands for **COM1.** Immediately to its left are a pair of pins with the designation C2 (for **COM2**). Move the jumper block from C1 to C2. Once you have done this, you are ready to move the second jumper.

Moving the Second Jumper

Notice the edge connector at the bottom of the card. It is about 3" long and has vertical gold "fingers". Above the edge connector towards its left boundary are the INTERRUPT REQUEST (**IRQ**) selection jumpers. The jumper positions are labeled above the pins with the designations 2, 3, 3A, 4A, 4, 5, and 7. As shipped, a jumper should be on position 4A (the IRQ line for COM1). To reconfigure your card as **COM2**, you must move the plastic jumper from position 4A to position 3A.

Your ComboPlus serial port is now set up as COM2.

3.2 Configuring Your Application Software

Most communications software can be configured to send data to whatever serial port you specify. For most PC compatible communications software, the specified communications port is COM1. If your asynchronous serial communications line is connected to a serial port designated as **COM2** (as in the case of a two-port system), it may be necessary to change your communication software to address **COM2** instead of COM1.

If you have any questions about configuring your software, consult the appropriate manual or dealer.

3.3 RS-232 Connector Pin List

In order to attach your PC's serial port to another serial device, you must use a multi-wire cable with the proper type (male or female) connectors at either end. In addition, you must make sure that the proper signals are being exchanged by your PC's serial port and the remote device's port to which it is connected. This is simply a matter of matching output lines to input lines and vice versa. For example, the pin which outputs data on the PC side of the link should be wired to the pin which receives data on the other side of the link. This is discussed in more detail in Appendix B.

The table below lists the signal configuration used by the serial port on your ComboPlus. This arrangement is known as DTE (for data terminal equipment). Use this information to make up the proper cable for your particular serial communication environment. Please make sure that pins 5, 6, and 8 (CTS, DSR, CD) of the DB25P (J1) connector are correctly wired to the proper incoming signals. The PC needs to "see" these signals in order to control communications. Note that only some of the 25 pins are used to wire the interface. You don't need to wire the unused pins. Appendix B has specific examples of correctly cabled interfaces.

If you are using several remote devices, which require different cabling arrangements, consider using adapter plugs to handle the line signal routing. That way you can use the same extension cable for all your devices, and simply change the adapter plug when you change device.

RS232C NAME	J1 PIN#	SIGNAL NAME	SIGNAL DIRECTION
AA	1	(Protective Ground)	Both
BA	2	TX (TRANSMIT DATA)	**OUTPUT**
BB	3	RX (RECEIVE DATA)	**INPUT**
CA	4	RTS (REQ. TO SEND)	**OUTPUT**
CB	5	CTS (CLR. TO SEND)	**INPUT**
CC	6	DSR (DATASET RDY)	**INPUT**
AB	7	SG (SIGNAL GND)	Both
CF	8	CD (CARRIER DET.)	**INPUT**
CD	20	DTR (DATATERM RDY)	**OUTPUT**
CE	22	RI (RING INDICATE)	**INPUT**

See appendices for more information on wiring serial connections.

4.0 Parallel Printer Port (Option P)

This chapter applies to ComboPlus boards equipped with the Parallel Printer (P) option. This is not to be confused with the serial option, discussed in chapter 3. If your ComboPlus card does not include this option, it can be added later. (See User Upgrade Information.)

The IBM PC allows up to three parallel printers to be attached, called **LPT1**, **LPT2**, and **LPT3**. The parallel printer port of the ComboPlus card can be configured as either **LPT1**, **LPT2**, or **LPT3**. Your ComboPlus card is configured at the factory as **LPT1**. **If this is the only parallel printer port on your system, your ComboPlus is ready as shipped.**

The interface to your parallel port is controlled under PC DOS. The MODE command allows you to configure the port's parameters (characters per line, lines per vertical inch). Consult your printer and DOS manuals for proper parameter settings.

4.1 Installing the Interface Cable

Place the ComboPlus card so that the black mounting bracket is towards the right. Near the top of the card, just to the right of the large, round battery housing is the set of pins designated as **J2** and **PRINTER PORT** that connect to the parallel port interface cable. (See Diagram A at the back of this manual.)

Notice the 18-inch-long gray interface cable supplied with your card. It has a small plastic connector at one end and a DB25S (socket or female type) connector at the other end. The small plastic connector plugs into **J2** of your ComboPlus card. The DB25S connector goes to your printer cable.

At one edge of the ribbon cable is either a red or black line. This marks the wire to be connected to the Pin 1 position of the set of pins labeled J2. Position the connector over **J2** of the ComboPlus card so that the red or black line is towards the left, closest to the battery housing on the ComboPlus card. Gently press the connector onto the row of pins. It should slide on easily with even pressure.

4.2 Reconfiguring Your Parallel Port for Multi-Port Systems

This section applies only if you are using more than one parallel port.

If you have an IBM Monochrome/Printer Adapter card: the printer port on the Monochrome/Printer card is **LPT1** and the printer port of the ComboPlus **automatically** defaults to **LPT2. In this particular case, no reconfiguring is needed on the ComboPlus card.**

If you have an IBM Parallel Printer Adapter or other parallel printer port: you can reconfigure the ComboPlus card to function as LPT2.

Place your ComboPlus card so that the black mounting bracket is towards the right. Notice the plastic jumper blocks about one inch to the left, about midway between the top and bottom edges of the card. There are four sets of pins, two of which are covered with plastic jumpers. We are concerned only with the jumper that is furthest to the left. It's a little hard to read, but immediately above that jumper is the designation P1. That stands for parallel port 1 (**LPT1**). Immediately to its left are two pins with the designation P2 (for **LPT2**). All you have to do is move the jumper from position P1 to position P2. See Diagram A for clarification.

4.3 Reconfiguring Your Parallel Printer Software

The IBM DOS command structure presently does not offer the ability to select (switch) between different parallel printer ports. If you are using two parallel printer ports, you will not be able to use the **PRINT SCREEN** command to output to LPT2. A two-line code patch will allow you to switch printer ports from the keyboard. See Appendix C for details.

Most PC DOS compatible software that sends data to a parallel printer can be configured to send data to whatever parallel port you specify. The default is usually **LPT1.** If your printer is connected to a parallel port designated as **LPT2**, it may be necessary to reconfigure your application software to address **LPT2.** If you have any questions about configuring your software, consult the appropriate manual or dealer.

4.4 Printer Port Connections

You can use the information below to make a cable for connecting to an IBM Parallel Printer. When wiring to other parallel printers, check for variations as not all printers have the same signal line connections. For minimal interference, you should use twisted pairs for the cable wirings. If you are

unsure how to construct a parallel interface cable, ask your printer dealer for assistance.

NOTE: The cable supplied with your ComboPlus card converts the card's parallel port output into the DB25 line signal format listed in the chart below. The J2 line outputs are supplied for reference only.

Parallel Port Signal Line Configuration

LINE NAME	J2 Pin	AST CABLE OUTPUT DB25S	IBM MATRIX PRINTER
-STROBE	1	1	1
D0	3	2	2
D1	5	3	3
D2	7	4	4
D3	9	5	5
D4	11	6	6
D5	13	7	7
D6	15	8	8
D7	17	9	9
-ACK	19	10	10
BUSY	21	11	11
PE	23	12	12
SLCT	25	13	13
-AUTOFD	2	14	14
-ERROR	4	15	32
-INIT	6	16	31
-SLCT IN	8	17	36
GROUND	(10,12,14,16, 18,20,22,24)	(18-25)	(16,19-30,33)

Note: A dash in front of the line name denotes lines which are functionally active when low.

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5.0 Clock-Calendar (Option C)

Your Clock-Calendar (**C**) option has the following features:

*24-hour clock

*Four-year calendar (no leap year)

*Battery back-up power supply
(battery life, approx. one year)

*User replaceable Lithium battery

*Full compatibility with PC DOS

*Optional CP/M 86 and CCP/M 86 compatibility available

The Clock-Calendar (**C**) option answers the TIME and DATE prompts which the DOS operating system issues each time you boot the system.

The lithium battery is easily replaceable and should last for about a year. The clock chip on your ComboPlus is powered by the PC system when your PC is on. The battery is used as back-up power while your PC is off. To replace the battery, slightly flex the retaining clip with your finger and use a small screwdriver to remove the battery from its holder. Replacement batteries can be purchased from the factory or your local watch or appliance store. (Part number Panasonic BR2325)
Take care not to damage or bend the retaining clip. The clip completes an electrical circuit and must make solid contact with the positive (+) side of the battery. When installing a new battery, make sure it is clean and dry.

5.1 Initialization

To initialize the clock-calendar option (after you have installed your ComboPlus card), copy the two clock programs, ASTCLOCK.COM and SETCLOCK.COM to your working DOS diskette. These programs are on the SuperPak diskette supplied with your ComboPlus. Your working DOS diskette must contain the usual DOS clock programs. If you are unsure how to COPY a file or how to create an AUTOEXEC.BAT file, consult your DOS manual.

Now, add the ASTCLOCK program to your AUTOEXEC.BAT file. ASTCLOCK is a utility program which reads and displays the

current time and date from the ComboPlus at each power up or reboot of the system. It then exits to DOS ("A>") when finished.

The following sequence of commands will create an AUTOEXEC.BAT file to automatically set the time and date for you every time you turn on or reboot the computer:

COPY CON: AUTOEXEC.BAT<ENTER>
ASTCLOCK<ENTER>
Function key F6<ENTER>

Your AUTOEXEC.BAT file may contain other commands in addition to running ASTCLOCK.

5.2 Setting the TIME and DATE

You need to execute the set time and date utility whenever you want to update the time or date of the clock. The DOS TIME and DATE commands only update the system's time and date parameters; they will not update the time and date values stored in the ComboPlus clock chip.

To set the clock on your ComboPlus (remember, the SETCLOCK program must be on your DOS diskette), type in the following instruction:

SETCLOCK<ENTER>

The system will display the current date and time. Typing DATE and TIME allows you to update these values in the ComboPlus' clock chip. When you are done, press keys **Ctrl**, **Alt**, and **Del** simultaneously (**reboot**) to exit the SETCLOCK utility. (Note: The REBOOT is required to set the ComboPlus clock parameters.)

If you replace the battery, be sure to use the SETCLOCK procedure to restore the proper time and date.

Device Addressing of the Clock-Calendar

This technical information is for reference only; you do not need to read this section to use the Clock-Calendar. The clock-calender is at I/O address Hex 2C0 and uses 32 contiguous locations for programming functions. See Appendix D for a breakdown of programming functions and locations.

6.0 Installing Your ComboPlus Card

The **ComboPlus** card can be inserted in any one of the five expansion slot receptacles on the PC system board.

CAUTION: BE SURE THE POWER IS OFF AND THE POWER CORD IS REMOVED FROM THE PC BEFORE INSTALLING OR REMOVING ANY EQUIPMENT.

1. Select a free expansion slot, and find the black metal bracket that covers the cut out in the back panel of the PC chassis. Remove and save the bracket-retaining screw using a small flathead screwdriver. Remove the bracket.

2. Find the black plastic card guide supplied with your ComboPlus. Locate the inside front panel of the PC chassis (near the speaker). Notice the vertical pairs of holes in the front inside panel. Select the pair of holes which lie in line with the slot you have chosen. Notice the "fingers" in the channel down the center of the card guide. With the fingers pointing down, press the card guide's two mounting studs into the holes in the panel.

3. Line up your ComboPlus card and position its front bottom corner in the card guide channel. Keeping the top of the ComboPlus level, lower the ComboPlus until its edge connector is resting on the expansion slot receptacle. Using an evenly distributed pressure, press the ComboPlus **straight down** until it seats in the expansion slot.

4. (OPTION P only) If your PC has a cut out above the keyboard connector on the rear panel, route the printer port adapter cable under all the cards and bring it out to the cut out. The cut out's plastic cover can be removed easily by pressing it towards the rear.

   If your PC does not have the cut out, use the supplied, extra short bracket to mount the DB25S connection. The end of this cable can be attached to the optional AST "ConnectAll" mounting device for a neat, secure installation.

5. Using the retaining screw from step 1, secure the ComboPlus card mounting bracket. Check again to be sure that the ComboPlus card and all other cards are securely seated in the slots.

6. It is now time to check to see if everything works. You can replace the system unit's cover prior to check out or you can wait until later. To replace the cover, carefully slide the cover from the front until it stops securely against the rear panel. Reinstall the two screws you removed earlier from the lower corners.

7. Replace the power cord to the system unit and be sure that the keyboard and the monitor connectors are plugged in.

6.1 Testing the New Installation

Insert a DOS diskette in drive A and turn on the power. The amount of the time the machine takes to run through the power up diagnostics will be longer than it was prior to installing the ComboPlus card. This is because the additional memory is tested to be sure it is functioning properly. A delay of 30 to 45 seconds is normal.

1. If all goes well, the system will boot as normal. If you get an error message or nothing happens, it is probably because the switch settings on the PC system board and/or the ComboPlus board are wrong. Check the switches again.

2. With the DOS diskette in drive A, type **CHKDSK<ENTER>**. The second line from the bottom of your display will indicate the number of bytes of total system memory.

TOTAL SYSTEM MEMORY	DISPLAYED	
128K	131072	
160K	163840	
192K	196608	
224K	229376	
256K	262144	
288K	294912	
320K	327680	
352K	360448	
384K	393216	
416K	425984	
448K	458752	
480K	491520	
512K	524288	
544K	557056	655360

(NOTE: Here again, the largest amount of memory the PC can "see" is tied to the switch settings on the system board. Hence, even if you have more than 544K installed, 544K will be the amount displayed when you type a CHKDSK command under DOS. This is also the case when running IBM Diagnostics; only 544K of memory will be tested. AST has diagnostics which will test memory above 544K. Ask your dealer for details.)

Verify that the amount of memory in your total system is as you expected. Next, run the IBM diagnostic routines to check out the options you have just installed. See your Guide to Operations manual for instructions. Note: The diagnostic routines do not test the Clock-Calendar option.

7.0 User Upgrade Information

The ComboPlus card is designed to allow easy user upgrade. To order the optional items, please use the following part numbers.

Memory Upgrade
-order part number MP-009 for each increment of 64K memory upgrade which consists of nine pieces of 64K dynamic RAM chips.
The AST memory diagnostic MC-099 is also recommended to verify memory operation. Appendix A has instructions for upgrading the memory.

Serial Option
-order part number MC-000S for async communication (RS-232) upgrade kit which consists of a UART, interface ICs, and documentation.

Parallel Printer Option
-order part number MC-000P for parallel printer upgrade kit which consists of all the necessary ICs, bracket, Printer cable adapter, and documentation.

Clock-Calendar Option
-order part number MC-000C for real-time clock upgrade kit which consists of the clock chip, battery, clock utility program, and documentation.

NOTE: ALTHOUGH THE AST COMBOPLUS CARD IS DESIGNED FOR EASY USER EXPANSION, THE WARRANTY COVERAGE APPLIES ONLY TO THE CONFIGURATION OF THE BOARD AS ORIGINALLY SHIPPED FROM THE FACTORY. THE EXPANSION SOCKETS AND ANY ADDITIONAL EXPANSION-RELATED COMPONENTS ARE NOT WARRANTED.

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Appendix A

Memory Upgrade Instructions

Step 1 - Determine the amount of memory you wish to add to the ComboPlus card in 64K increments (i.e., 64K, 128K, or 192K). This will increase the ComboPlus memory size to 128K, 192K, or 256K bytes.

Step 2 - Order one AST part number MP-009 for each increment of 64K memory upgrade you wish to add to your ComboPlus.

*one MP-009 equals 64K additional memory, bringing ComboPlus card to 128K, and system to 192K.
*two MP-009 equal 128K additional memory, bringing ComboPlus card to 192K, and system to 256K.
*three MP-009 equal 192K additional memory, bringing ComboPlus card to 256K, and system to 320K.

Each row of sockets (64K bank) will need 9 pieces of the 64K RAMs with access time of 150nsec or 200nsec maximum, +5 volts only, pin 1 not used.

Recommended 64Kx1 dynamic RAMs

Micron Technology MT4264-3
Motorola MCM6665AL-20, MCM6665AP-20
NEC D4164D-2, D4164C-2
OKI M3764-20RS
Hitachi HM4864P-3
Fujitsu MB8264-20
Mitsubishi M5K4164NS-20
Texas Instruments TMS4164-20NLJ

When handling dynamic RAMs, please take extra care to protect them from electrostatic discharge.

Step 3 - Power off your PC and any peripherals attached to the machine. Remove the cover, undo the retaining screw, and carefully remove your ComboPlus card. Install one dynamic RAM into each of the sockets as shown in Diagram A.

Be sure to follow the installation instructions when you reinstall your ComboPlus card in your PC. You will have to reset the switches on the PC system board. Follow the instructions in this manual.

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Appendix B

Recommended Serial Port Cabling

This section contains pin connections and wiring configurations for interfacing the serial port on your ComboPlus to specific serial printers and MODEMs. For information on wiring other product interfaces, consult Appendix F of this manual and your serial device's manual, or call your printer manufacturer and tell them you wish to connect to an IBM PC Asynchronous Serial Port. Your ComboPlus serial port is compatible with the IBM serial port.

--- --- --- --- --- --- --- --- --- --- --- --- ---

Suggested wiring to MODEM devices (Haye Stack Smart MODEM, Novation Cat, UDS, etc):

```
 ComboPlus              MODEM
Serial Port              Port
 Connector            Connector

     1-------------------1
     2-------------------2
     3-------------------3
     4-------------------4
     5-------------------5
     6-------------------6
     7-------------------7
     8-------------------8
    20------------------20
    22------------------22
```

Use a DB25S (female/socket) connector for the ComboPlus side and a DB25P (male/plug) connector for the MODEM side.

--- --- --- --- --- --- --- --- --- --- --- --- ---

Suggested wiring for NEC 7700 series, TI 810 series, Epson MX-100-3 and Brother HR-1 serial printers:

```
 ComboPlus             Printer
Serial Port              Port
 Connector            Connector

     1-------------------1
     2-------------------3
     3-------------------2
     4-------------------5
     5------------------11  TI, Brother, Epson only
     5------------------19  NEC printer only
   6,8------------------20
     7-------------------7
    20------------------6,8
```

Pins 6 and 8 on the PC side are wired together and connected to pin 20 from the printer. The same is true in the "other direction".

This wiring allows the printer to inform the PC that its receiving buffer is full. Use DB25S (female/socket) connector for the ComboPlus serial port and a DB25P (male/plug) for the printer.

--- --- --- --- --- --- --- --- --- --- --- --- ---

Suggested wiring for the Qume Sprint 9/45, 9/55 printers:

```
        ComboPlus            Printer
       Serial Port             Port
        Connector           Connector

          1--------------------1
          2--------------------3
          3--------------------2
          4--------------------5
          5-------------------20
          6,8------------------4
          7--------------------7
         20-------------------6,8
```

This wiring allows the Qume printer to inform the PC that its receiving buffer is full. Use DB25S (female/socket) for the ComboPlus serial port and a DB25P (male/plug) for the Qume printer.

--- --- --- --- --- --- --- --- --- --- --- --- ---

Suggested wiring for CRTs and printers running at low baud rates (110-300):

```
        ComboPlus          CRT/Printer
       Serial Port             Port
        Connector           Connector

          1--------------------1
          2--------------------3
          3--------------------2
          7--------------------7
          4,5                 ---
          6,8-----------------20
         ---                   5,20 or 4,5 if needed
```

This wiring does not use standard EIA RS-232C handshaking; however, it should work with most CRTs and some printers. Use DB25S (female/socket) for the ComboPlus serial port and a DB25P (male/plug) for the CRT or printer (in most cases). Notice that pins 4, 5, and 20 on the CRT side can be wired together.

Suggested wiring for the Diablo 620 printer:

```
  ComboPlus             Diablo 620
 Serial Port            Serial Port
  Connector              Connector

       1--------------------1
       2--------------------3
       3--------------------2
       5--------------------4
       7--------------------7
       6,8-----------------20
      20--------------------6
```

This arrangement allows the Diablo to inform the PC side of the interface that its receive buffer is full. Notice that pins 6 and 8 on the PC side are wired together, and then commonly connected to pin 20 on the Diablo 620 side.

--- --- --- --- --- --- --- --- --- --- --- --- ---

Suggested wiring for the Smith-Corona TP-1:

```
  ComboPlus             Smith-Corona
 Serial Port            Serial Port
  Connector              Connector

       1--------------------1
       2--------------------3
       3--------------------2
       4--------------------5
       5--------------------4
       6,8,20              ---
       7--------------------7
      ---                   6,8,20
```

This arrangement gives the TP-1 sufficient control over output from the PC side of the interface. Notice that pins 6, 8, and 20 are connected to each other on either side of the link. This allows both devices to remain in a ready state, while pins 4 and 5 actually control the flow of data from one side to the other.

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Appendix C

Switching Between LPT1 and LPT2

The following program can be used in the .BAT mode to direct printer output, normally designated for the device attached to port LPT1, to instead be routed to the device attached to port LPT2. (The program also directs output, normally designated for the device attached to port LPT2, to instead be routed to the device attached to port LPT1.)

This can be used when your LPT1 printer (call it printer #1) is down for service, or when you desire, say, the type style or speed of the printer attached to LPT2 (call it printer #2). This program allows you to quickly switch between outputs without having to alter your hardware interface or change each line in programs where LPT1 or LPT2 appear as your output port designation.

If your printers are not configured to the same parameters, as defined in the PC DOS MODE command, it will be necessary to add two MODE statements when switching devices.

You will note that the "swap" program below is written in BASIC. Since the printer port swap is best handled in DOS, it is necessary to invoke BASIC within the .BAT file. No RUN command is required when the BASIC call and the program filename occur on the same line.

The following batch file and BASIC program will redirect printer output from LPT1 to LPT2 or vice versa, depending on which port is being used at the time.

LPTSWAP.BAT (or a name of your choosing) with the following:

```
MODE LPT1:[parameters for printer #2 (if needed)]
MODE LPT2:[parameters for printer #1 (if needed)]
BASIC LPTSWAP
```

LPTSWAP is a BASIC file, as below. The comments are included for clarification and should not be included in the actual program:

```
10 DEF SEG=&H40                           ;finds port address table
20 A=PEEK (8): B=PEEK (9)                 ;save LPT1 address
30 POKE 8,PEEK (10): POKE 9,PEEK (11)     ;LPT2 address to LPT1
40 POKE 10,A: POKE 11,B                   ;LPT1 address to LPT2
50 SYSTEM                                 ;return to DOS
```

<u>To restore LPT1: to LPT1: AND ALSO to restore LPT2: to LPT2:</u>

Use the same program, LPTSWAP, to restore your parallel printer ports to their original arrangement. Be sure to restore the proper parameters using a new batch file and MODE statements.

LPTRSTR.BAT is as follows:

```
MODE LPT1:[parameters for printer #1 (if needed)]
MODE LPT2:[parameters for printer #2 (if needed)]
BASIC LPTSWAP
```

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Appendix D

I/O Addressing: Clock-Calendar Chip - MM58167A

I/O Address Offset	Function
00	counter-1/10000 of seconds
01	counter-1/100 and 1/10 seconds
02	counter-seconds
03	counter-minutes
04	counter-hours
05	counter-days of the week
06	counter-day of the month
07	counter-month
08	RAM-year
09	RAM-year
0A	RAM-year
0B	RAM-not used
0C	RAM-not used
0D	RAM-not used
0E	RAM-not used
0F	RAM-not used
10	interrupt status register
11	interrupt control register
12	counter reset
13	RAM reset
14	status bit
15	GO command
16	standby interrupt
1F	test mode

Counter and RAM reset format

Data	Function
01	1/10000 of seconds
02	1/100 and 1/10 of seconds
04	seconds
08	minutes
10	hours
20	days of the week
40	day of the month
80	month

Clock-Calendar base port address: 2C0

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Appendix E

GENERAL PROCEDURE FOR APPLYING PATCHES

A patch is a short program which alters the way the operating system usually handles a particular situation. AST recommends the following procedure for applying "patches":

Create a DOS diskette which contains the DEBUG utility and the program to be patched. (Your DOS manual explains the use and function of the DEBUG utility.) Place this disk in drive A and boot the computer. After the patch is applied, the new (patched) version can be copied over to your working diskettes. DO NOT APPLY PATCHES TO YOUR MASTER DISKETTES -- USE BACKUPS ONLY! TEST THE PATCHED VERSION BEFORE ACTUALLY USING IT!

In the following procedures, the user enters all **boldface** text, exactly as shown; BE SURE TO INCLUDE SPACES. Terminate each entry line with the "enter" key. The computer responds with all other output. Refer to your DOS manual for more information on using the DEBUG commands.

SuperSpool Printer Status Errors

When running SuperSpool versions 1.00 and 1.01 (diskette P/N 210-1160-2, 210-1160-2.1, and 210-1160-2.2) with certain application programs, a "Printer Not Available" error sometimes occurs. The following patch to your SuperSpool program will correct this.

```
A>debug superspl.com
-e 17c
04FA:017C  2A.b4  E4.90
-e 19e
04FA:019E  2A.b4  E4.10
-w
Writing 1555 bytes
-q
A>
```

Patch for DOS 1.1 Version of DISKCOPY Utility

The DOS 1.1 version of the DISKCOPY utility has a bug in it which only manifests itself when the user has a large amount of memory (enough to hold an entire double sided disk) and double sided disk drives. DISKCOPY will get into an error loop and try to read past the end of the source drive. The following patch will correct the problem.

```
A>debug diskcopy.com
-e861 e8 74 00
-e8d8 3d 51 00 72 02 b0 50 a2 36 05 c3
-rcx
CX 07D8
:7e3
```

(continued)

```
-w
Writing 07E3 bytes
-q

A>
```

Patch for DOS 1.1 Version of DISKCOMP Utility

The DOS 1.1 version of the DISKCOMP utility contains a bug which will prevent successful operation when the user has a large amount of memory and double sided drives. The following patch will correct this problem.

```
A>debug diskcomp.com
-e6ec e8 79 00
-e768 3d 51 00 72 02 b0 50 a2 95 04 c3
-rcx
CX 0668
:673
-w
Writing 0673 bytes
-q

A>
```

Patch for WordStar (TM) INSTALL.BAS Program

There is a problem in the Version 3.20 WordStar (TM MicroPro) INSTALL.BAS program when trying to interface to an NEC Spinwriter serial printer. Line 3170 of INSTALL.BAS should have six ",0" characters at the end; **if there are only five, add another one.**

Pre-configuring DOS 1.1 Version for Four Drives

The following sequence of commands will patch DOS Version 1.1 so that it thinks there are always four disk drives in the system, regardless of the setting of system switch #1, positions 7 and 8. This patch applies ONLY to DOS 1.1. Once it is made, take care to distinguish this version of DOS from the normal version.

```
A>DEBUG
-L100 0 7 2  OR  L100 0 142 2 if double sided drives
-E34F
04FA:034F  D0.2B (SPACE - DEBUG GOES TO NEXT LINE)
04FA:0350  C0.C0  25.06  03.8E  00.C0  75.80  06.0E  06.10  06.04
04FA:0358  01.C0  04.07  01.B8  40.04  40.00
-W100 0 7 2  OR  W100 0 142 2 if double sided drives
-Q

A>
Reboot computer.
```

Appendix F

Wiring Your PC Serial Port to Remote Serial Devices Using the Electronic Industry Association RS-232C Standard Interface

AST Research carefully designs its RS-232 interfaces to ensure that the PC's operating system software and hardware will utilize the serial port in a manner consistent with IBM's notions of what the serial port should "look like" to the system. In addition, AST designs its products so they are easy to reconfigure. For example, there is no etch cutting or soldering required to reconfigure a serial port from COM1 to COM2. To make this change you simply move two jumpers to different pairs of pins.

The EIA RS-232C standard describes the arrangement of control and data signals on both sides of a serial communications interface. As a reference point to model the standard on, the RS-232 document describes an ideal case in which a data terminal is connected to a MODEM. A MODEM is a MOdulator/DEModulator used to connect a terminal to a communications device. The communications device interfaces to a transmission medium (for example, phone lines) which carry the signal to a similar device connected to a port on another DTE port or the communications element of a mainframe computer system (either of which we can call the "remote").

The EIA standard provides for various signals to be sent between a data terminal (DTE) and a data communications device (DCE), to control the exchange of data to and from the local MODEM and local terminal. These signals travel on separate wires from pins on the DTE side (terminal) to pins on the DCE side (MODEM).

For asynchronous applications such as your AST card serial port, we are interested in the "states" of only eight or nine (of the twenty-five possible) wires between the DTE (your PC port) and the DCE (a MODEM or serial printer DCE port).

Let's look at an ideal case set up first so that you will become acquainted with the signal and sequence requirements of the RS-232 standard. In our ideal case scenario, we'll imagine we are connecting the serial port on your AST card (DTE) to a telephone MODEM (DCE). A correctly configured DCE/DTE interface will be wired "straight across"; i.e., pin 20 on the DTE side will be wired to pin 20 on the DCE side, pin 2 to pin 2, and so forth. Let's see what sort of "handshaking" (the manner in which two devices are set to interact so as to function properly) has to take place.

When the DTE serial port on your PC wants to transmit some data it raises the voltage, or "brings up", pin 20 which is known as DTR (data terminal ready). This voltage travels to pin 20 on the DCE side where, ideally, the DCE MODEM tells itself that a communications link is being requested by the terminal device. Assuming that an open phone line exists, the DCE brings up two lines on its side of the interface; DSR (data set ready, pin 6) and DCD (data carrier detect, pin 8). When the DTE (remember,

that's your PC port) sees voltage at its pins 6 and 8, it is free to bring up pin 4, RTS (request to send). This tells the DCE, in effect, that "I've got data to transmit to you right now!" The DCE checks to make sure it is ready to receive data and, if so, brings up pin 5, CTS (clear to send). The DTE, seeing voltage on its pin 5, starts transmitting on the wire connected to pin 2, TD (transmit data). Any incoming traffic is received at pin 3, RD (receive data). (NOTE: some MODEMs have an automatic answer mode which uses pin 22, the Ring Indicator (RI) to alert the terminal that incoming data is due. The terminal responds with DTR.) One other thing: be sure to wire pins 1 and 7. They are ground wires and can help protect your equipment from damage.

Figure A, below, shows which signals are used between the DTE and DCE and in which "direction" they travel.

Figure A

The Ideal: Terminal to MODEM

```
      PC Side                                      MODEM Side

   Signal  Pin #                                Pin#  Signal
                DTE                        DCE
 Ground     1    |--------------------|     1    Ground
                 |                    |
 Ground     7    |--------------------|     7    Ground
                 |                    |
                 |                    |
  (RI)     22    |<- - - - - - - - - -|    22     (RI)
 -  -   -  -   -   -   -   -   -   -    -   -   -   -
                 |                    |
   DTR     20    |------------------->|    20     DTR
                 |                    |
                 |                    |
   DCD     8     |<-------------------|    8      DCD
                 |                    |
                 |                    |
   DSR     6     |<-------------------|    6      DSR
                 |                    |
                 |                    |
   RTS     4     |------------------->|    4      RTS
                 |                    |
                 |                    |
   CTS     5     |<-------------------|    5      CTS
                 |                    |
                 |                    |
   TxD     2     |------------------->|    2      TxD
                 |                    |
                 |                    |
   RxD     3     |<-------------------|    3      Rxd
                 |                    |
```

Notice that the INPUT signals on the DTE side of the interface are DCD, DSR, CTS, and RxD. Also, the DTE has OUTPUT DTR, and RTS. These are the signals which must be handled by the interface before the DTE can transmit or receive data.

Now notice the SEQUENCE in which these signals occur (top to bottom in Figure A). From the DTE's standpoint, he must send DTR, see DCD, see DSR, send RTS, and see CTS before he can transmit or receive data. That is, the INPUTS must have voltage applied to them or the interface cannot become operational. (The outputs matter only in that they are inputs to the DCE side of the interface.) The hardware which controls the DTE serial interface will not release data to the communications link until the proper set and sequence of signals has been received.

One other concept: you can think of certain pins on one side of the interface as being "functional pairs". When the AST serial port sends DTR, it expects to see DSR (and DCD) raised in response. DTR and DSR are signal and response to one another. For this reason we will think of them as a pair. The same is true of RTS and CTS, and of TxD and RxD. This concept will be taken up again later in our discussion.

NOW LET'S LOOK AT A TYPICAL (NON-IDEAL) CASE

DTE to DTE Interfaces

As is often the case, many devices, such as serial printers, are set up as DTEs. To output data from your PC serial port (also DTE) to a serial printer or other DTE device requires the wiring of a DTE to DTE interface. Such an interface must fool each side of the link into thinking that it is receiving "response" inputs from a DCE. As mentioned above, not only must the input voltages be present, but they must become present in the correct sequence (although, this varies from device to device).

To illustrate, let's look at the case presented in Figure B.

Figure B

Example of a Specific DTE to DTE Interface

```
PC Serial Port Side              Qume Sprint 9/45 Serial Printer

  Signal   Pin#                                  Pin#   Signal
                 DTE                     DTE
 Ground     1    |-------------------|          1      Ground
                 |                   |
 Ground     7    |-------------------|          7      Ground
                 |                   |
                 |                   |
   DTR     20    |------|      |-----|         20       DTR
                 |      |      |     |
   DCD      8    |<--|  |______|__|->|          8       DCD
                 |   |         |  |  |
                 |   |__       |  |  |
   DSR      6    |<--|  |      |  |->|          6       DSR
                 |      |      |     |
                 |      |      |     |
   RTS      4    |--|   |------|-----|          4       RTS
                 |  |          |     |
                 |  |----------|-|   |
   CTS      5    |<------------| |-->|          5       CTS
                 |                   |
                 |                   |
   TxD      2    |--------|    |-----|          2       TxD
                 |        |    |     |
                 |        |----|-|   |
   RxD      3    |<------------| |->|           3       RxD
                 |                   |
```

Notice that the necessary input signals have been supplied to both sides. DCD, DSR, and CTS have voltage applied to them on either side. The integrated circuit which controls the PC side (INS 8250) is fairly flexible in reading the sequence of inputs. That is why we can "drive" CTS with DTR from the printer's side. You'll notice that this is the only sequencing rule that we've broken. Why have we done this? The Qume manual explains that when the printer's receive buffer is about to fill up it "drops" its DTR signal. Since we don't want to lose data by overflowing the printer's receive buffer, we need to immediately halt the output of data from the PC side of the interface. The best way to do this is to immediately drop the clear to send (CTS) input on the PC side. By having the printer's DTR output drive the PC's CTS input, we can ensure that this kind of control will occur. The remainder of the interface will "idle" until the printer "raises" DTR again. (Remember, this is a specific case for Qume serial printers.)

Let's look at another example of interfacing a serial DTE printer to the PC's AST card serial port.

Figure C

AST Serial Port DTE to NEC 7700 Series Serial DTE Printer

```
PC Serial Port Side              NEC 7700 Series Printer Side

 Signal    Pin#                                  Pin#    Signal
                 DTE                       DTE
 Ground     1    |-------------------|      1     Ground
                 |                   |
 Ground     7    |-------------------|      7     Ground
                 |                   |
                 |                   |
   DTR     20    |-----|       |-----|     20      DTR
                 |     |       |     |
                 |     |       |     |
   DCD      8    |<--| |       | |-->|      8      DCD
                 |   | |-------|-|   |
                 |   |---------| |   |
   DSR      6    |<--|           |-->|      6      DSR
                 |                   |
                 |                   |
   RTS      4    |-------|   |-------|     19      SRTS
                 |       |---|--|    |
                 |           |  |    |
   CTS      5    |<----------|  |--->|      5      CTS
                 |                   |
                 |                   |
   TxD      2    |-------|   |-------|      2      TxD
                 |       |---|--|    |
                 |           |  |    |
   RxD      3    |<----------|  |--->|      3      RxD
                 |                   |
```

In this case, the printer uses line 19, a Secondary Request to Send (SRTS), instead of pin 4. Other than this oddity, careful examination of the interface will show that all of our DTE input and sequence rules have been followed. On both sides DCD, DSR, and CTS are raised, and in the top-down sequence we are generally trying to follow for these signals.

Another nice thing about this particular wiring is that all of the pins are driven by their functional counterparts on the other side of the interface. You'll recall in our Ideal Case scenario we mentioned functionally related "pairs" of pins. (DTR/DSR, RTS/CTS, and TxD/RxD.) Figure C shows that an element of a pair on one side of the interface, is driving its partner element on the other side of the interface. When sequence is important, this is a good way to tell if your interface will work or not.

Any Serial Device manual worth the paper it's printed on will tell you how the device uses the RS-232 line signals and which pin numbers supply which signals. If your device manual doesn't give you enough information to go on, call or write the device company and tell them you are interfacing their product to an IBM Personal Computer Asynchronous Serial Port. Serial ports on all AST cards are set up to be functionally identical to the IBM product. The appendices of your AST product manual may also be of some help, and your dealer can usually assist you if you have problems. Your dealer can also direct you to a parts store which carries the products you need to construct an interface cable. Be sure you buy the correct type of 25 pin connectors (male or female) to connect both ends properly. Your AST serial port end requires a DB25S, female or socket type connector.

To properly wire your serial interface signals, we suggest you use the form below as a design aid.

```
                 AST Serial Port        ____________________________
                   IBM PC Side

       Signal    Pin#                               Pin#   Signal
                     DTE
                       |                   |
       Ground     1    |-------------------|     1     Ground
                       |                   |
       Ground     7    |-------------------|     7     Ground
                       |                   |
                       |                   |
Output     DTR   20    |                   |
                       |                   |
                       |                   |
Input      DCD    8    |<                  |
                       |                   |
                       |                   |
Input      DSR    6    |<                  |
                       |                   |
                       |                   |
Output     RTS    4    |                   |
                       |                   |
                       |                   |
Input      CTS    5    |<                  |
                       |                   |
                       |                   |
Data Out   TxD    2    |                   |
                       |                   |
                       |                   |
Data In    RxD    3    |<                  |
                       |                   |
```

Helpful Hint: If you have several different serial devices which will be using your serial port, make all your wiring translations in small assemblies. Then you can use the same long cable to connect your PC to any of these devices.

SuperDrive™ & SuperSpool

SuperDrive & SuperSpool
SuperDrive & SuperSpool
SuperDrive & SuperSpool

Guide to Installation & Operation

AST RESEARCH INC.

SuperDrive / SuperSpool

User's Manual

AST RESEARCH INC.
2372 Morse Avenue, Irvine, California 92714
(714) 540-1333

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****

SuperDrive / SuperSpool User's Manual

****

1.0 Introduction - SuperDrive and SuperSpool Utility Software

This manual describes the use and operation of the SuperDrive and SuperSpool utility programs. The SuperPak disk which came with your board is a formatted data disk containing your utility software. These utility programs can be copied over to your working DOS or data disks using the COPY command. Once you have copied the programs onto your working disks, you should store the SuperPak master disk in a safe place.

SuperDrive™ (SUPERDRV.COM) is a program which simulates disk drives within the Random Access Memory (RAM) of your system. This enables you to retrieve and store data and command (program) files much faster than the usual mechanical disk acquisition and transfer time allows.

SuperSpool™ (SUPERSPL.COM) is a program which outputs data to a printer while permitting the user to simultaneously perform other tasks on your PC. Your print output is stored in a predefined area of memory and "clocked out" using PC interrupt timing. The microprocessor is freed from having to waste its valuable processing time waiting for the printer. This means your PC can execute other software in the "foreground", while the printing of data is handled by SuperSpool in the "background".

Both SuperDrive and SuperSpool will save you time and effort if they are installed and used properly. A careful reading of these instructions will acquaint you with the capabilities of SuperDrive and SuperSpool. Section 6 contains a short glossary of certain "technical terms" used in this manual in describing the operation and capabilities of these utilities.

The instructions in this manual apply ONLY to version 1.10 and subsequent versions of both programs.

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2.0

SuperDrive

2.1 Introduction

The SuperDrive electronic disk program can greatly enhance the processing speed of your IBM Personal Computer (PC). You can now assign RAM memory space for use as up to four SuperDrive electronic disk drives, and retrieve data or programs at "RAM speeds", much faster than mechanical disk acquisition speeds allow.

The SuperDrive command parameters allow you to specify the size of memory to be reserved for your applications program. This ensures that programs requiring a specific minimal amount of memory will be allotted sufficient memory space for proper operation. The minimum (and default) program memory space allotted is 64K bytes. The command parameters also allow you to specify the desired capacity of a SuperDrive disk so that you can assign multiple SuperDrives within a given memory size. For example, you can have three 20K-capacity drives resident in an area about 70K in size. (Some additional space is required for disk format overhead.)

2.2 SuperDrive Features

-- Allows simulation of up to four electronic disks

-- Allows an electronic disk to be inserted between existing physical disk drives

-- Allows user to define the size of program and electronic disk memory spaces

-- Allows user to restrict SuperDrive operation to specific areas of memory

-- Supports single and double sided electronic drives

-- PC DOS compatible

2.3 SuperDrive PC System Preparation Guide

This section describes the steps necessary to prepare your PC for SuperDrive operation.

1. PC System Board Switch #1 - System Board Switch #1 is used to tell the system how many disk drives are present. Since a SuperDrive is treated just like any other drive, these switches must be set to reflect the total number of drives, including SuperDrives. It is acceptable for you to set your PC's switch #1 for more floppy drives than are actually installed, even when you are not using SuperDrive. When not using SuperDrive, if you try to access a non-existent floppy, you will get "NOT READY ERROR READING..." type messages. You can escape from this "error" situation by choosing the ABORT option when prompted by the operating system (about five seconds after you enter the invalid drive ID).

For Example: If there is currently one drive in your PC, system board switch #1, positions 7 and 8, will probably be ON. If you intend to add two SuperDrive disk drives to your system, you must tell the computer you have three drives (i.e., position 7 ON and 8 OFF). You can actually set switch #1, positions 7 and 8, to both OFF to allow simulation of up to four SuperDrives, but this will take up about one more kilobyte of memory by DOS to set up tables for the extra drives.

Switch #1 on the PC System Board
(not the switch on the AST memory board)

Total No. of Drives	Switch Position 1	2	3	4	5	6	7	8
2	*	*	OFF	OFF	*	*	OFF	ON
3	*	*	OFF	OFF	*	*	ON	OFF
4	*	*	OFF	OFF	*	*	OFF	OFF

* do not alter

2. You treat your SuperDrive disks just like your physical disk drives. All DOS utilities should function as normal unless a SuperDrive disk drive was "short" due to insufficient memory (see the discussion in section 2.4.2 on the /U=xxx and /M=xxx options). In such cases, utilities such as DISKCOPY will no longer copy complete diskettes successfully. The COPY utility may be used to move individual files back and forth, up to the disk drives' total capacities.

IMPORTANT: DO NOT USE THE DOS "FORMAT" COMMAND ON A "SHORT" SUPERDRIVE DISK. The SUPERDRV command files automatically format the SuperDrive disk according to DOS format requirements.

2.4 SuperDrive Command Format and Options

IMPORTANT: When creating multiple SuperDrives, they must be created successively with no other commands or operations in between. To reconfigure your SuperDrives, you must reboot the computer (pressing Ctrl, Alt, and Del simultaneously).

To invoke the SuperDrive program (after your system has been properly prepared; see previous section, 2.3), type in a command of the following format (UPPERCASE and lowercase entry are both acceptable):

SUPERDRV d:[/M=xxx][/U=xxx][/1][/2][/I][/DH][/DL][/DNC]<ENTER>

The word SUPERDRV invokes the SuperDrive program's command handler routines (SUPERDRV.COM must be resident on your DOS diskette). The remainder of the command syntax specifies the various options. These options are described in the following three sections.

2.4.1 Drive Selection and Configuration Parameters

d: A letter denoting the identity of the drive to be simulated in RAM. ("A", "B", "C", or "D" are the only valid drive identifiers.)

/1 Creates a single sided drive. 160K is the default single sided drive size. To specify a non-standard capacity, see the /M command below. If insufficient memory is available for the size selected, SuperDrive will take whatever is available and report the rest as "short xxx bytes".

/2 Creates a double sided drive. The SuperDrive program default drive type is double sided. If you do not use the /1 or /2 syntax, the program will assume you wish to create a double sided drive. 320K is the default capacity of the double sided drive. To specify a non-standard capacity, see the /M command below. If insufficient memory is available for the size selected, SuperDrive will take whatever is available and report the rest as "short xxx bytes".

/I This parameter causes a SuperDrive to be **inserted** logically as drive D. Any physical disk drive or SuperDrive currently defined as drive D will be "pushed" up one drive position (i.e., "SUPERDRV A:/I" causes drive A (whether a SuperDrive or a floppy drive) to become drive B, drive B becomes drive C, etc.). Other drives which come logically after the inserted drive will also be pushed up one position. Remember that DOS will only support four drives: A, B, C, and D.

(A note of caution: you should not place a SuperDrive disk unit in place of a real physical drive without using the /I option, or the real physical drive will no longer be accessible until the system is rebooted.)

2.4.2 Memory Allocation Parameters

/U=xxx This option reserves a minimum of xxxK bytes of memory for the application program and its work space. If no /U parameter is specified, SuperDrive will reserve a minimum default program space of 64K. This memory will not be used by the SuperDrive program.

The purpose of the /U parameter is to make sure that you leave enough room for your application software to execute properly. If your application software manual says the program requires 128K of memory to execute, you should use /U=128 in your command syntax. This ensures that at least 128K of RAM is available, within which your application software will reside and execute.

NOTE: If you use the /U option, you must use the **exact same** /U parameter in all SuperDrive and SuperSpool command parameters.

/M=xxx This option reserves xxxK bytes of memory for use by SuperDrive. This memory is not used by your application program.

Without this option, as much memory as possible will be allocated to SuperDrive, up to the default storage size of the SuperDrive disk. (The /1 and /2 options will influence the default storage size.) With the /M option, only the desired amount of memory will be allocated to the selected SuperDrive. This can be used to apportion SuperDrive memory space and will allow you, for example, to create multiple SuperDrives of specific capacities. When you wish to create a standard-sized single or double sided drive, you should not use the /M option since /1 and /2 automatically allocate the proper amount needed.

Note: The actual storage capacity of a disk will always be slightly less than the rated assigned value; DOS uses some of the disk's capacity for its housekeeping.

NOTE: The following three options are provided for users who must restrict SuperDrive and SuperSpool to operate in specific areas of memory. These options are extremely powerful in that they give the user great control over how SuperDrive and SuperSpool use memory. <u>The typical user need not concern himself with these options.</u> Study and understand these commands before you try using them. If any of these options are used, they will affect <u>only</u> the current command being entered. This means different combinations can be used on successive SuperDrive and SuperSpool command entries. See section 5 for more information.

/DH This option ("Disable High-Memory Use") prevents SuperDrive and SuperSpool from using any portion of contiguous memory which might be available above the limit set by the system board switches. It does not, however, prevent them from using any noncontiguous memory which may be present beginning at address C0000 and up, or from using memory available below the switch settings. It has no effect if there is no contiguous memory available above the switch settings. It may be used in conjunction with /DNC to restrict SuperDrive and SuperSpool to

operation in contiguous memory below the switch settings only. It may be used in conjunction with /DL to restrict SuperDrive and SuperSpool to operation in non-contiguous memory only.

/DL This option ("Disable Low-Memory Use") prevents SuperDrive and SuperSpool from using any portion of contiguous memory below the limit set by the system board switches. It restricts them to memory available above the switch settings. If non-contiguous memory is available beginning at address C0000, it is used first. This implies that there must be memory available above the switch settings in order to use this option. It may be used in conjunction with /DH to restrict SuperDrive and SuperSpool to operation in non-contiguous memory only. It may be used in conjunction with /DNC to restrict them to operation in contiguous memory above the switch settings only.

/DNC This option ("Disable Non-Contiguous Memory Use") prevents SuperDrive and SuperSpool from using any non-contiguous memory which may be available beginning at address C0000. If contiguous memory is available above the limit set by the switch settings, it is used first. It may be used in conjunction with /DL option to restrict SuperDrive and SuperSpool to operation only in contiguous memory available above the switch settings. It may be used in conjunction with /DH option to restrict their operation to contiguous memory available below the switch settings only.

2.4.3 Miscellaneous Parameters

/E This parameter creates an 80-track SuperDrive. THIS FUNCTION IS NOT SUPPORTED BY PC DOS.

/S=x This parameter specifies the number of sectors per track (either 8 or 10); default value is 8 sectors per track, which is also the only value supported by PC DOS.

2.5 Examples of SuperDrive Command Syntax

The examples below are provided to clarify the use of the SUPERDRV command syntax. Once you have a basic understanding of the program, SuperDrive is really quite simple to use. AST recommends that you review and understand these commands before you try to use SuperDrive for the first time. This will eliminate errors and save you time and effort (and frustration as well).

In each of the following examples, it is assumed the user has two floppy drives (physical drives A and B), has set his system board switches for a total of four floppy drives, and has sufficient memory to successfully execute the commands without error. Attempting to create a SuperDrive with incorrect switch settings may result in an "INVALID DRIVE SPECIFICATION" error. If there is insufficient memory available to create any SuperDrive, an "INSUFFICIENT MEMORY" error occurs. If some memory is available, but not enough for the size drive you want to create, the drive will be "Short xxxx Bytes".

SUPERDRV C:<ENTER>

Allocates a minimum of 64K bytes of memory for application program (since we did not use the /U=xxx parameter, the default value of 64K is used). Since we did not specify a specific size drive, the default value is used; adds one 320K-byte, double sided SuperDrive as drive C.

SUPERDRV C:/1<ENTER>

Allocates a minimum of 64K bytes of memory (by default) for application program. Adds one 160K-byte, single sided SuperDrive as drive C.

SUPERDRV B:<ENTER>
SUPERDRV C:/1<ENTER>

Allocates a minimum of 64K bytes of memory for application program. Adds one 320K-byte, double sided SuperDrive as drive B which replaces physical disk drive B. Physical drive B is no longer accessible. Drive C becomes a single sided, 160K-byte Superdrive disk drive.

SUPERDRV A:/I/1<ENTER>

Allocates a minimum of 64K bytes of memory for application program. Inserts a 160K-byte, single sided SuperDrive disk drive as drive A. Physical drive A becomes drive B. Physical drive B becomes drive C.

SUPERDRV C:/U=128/1<ENTER>

Allocates a minimum of 128K bytes of memory as application program memory, and adds a 160K-byte, single sided SuperDrive disk drive as drive C.

SUPERDRV B:/U=128/M=80/1/I<ENTER>
SUPERDRV D:/U=128/M=100/1<ENTER>

Allocates a minimum of 128K bytes for application program memory, then inserts an 80K-byte single sided SuperDrive as drive B. Physical drive B becomes drive C. Drive D is added, with 100K of capacity in single sided format.

Note that the same /U=xxx parameter must be used in each command.

SUPERDRV C:/U=256/M=100/1/DH<ENTER>

Allocates a minimum of 256K bytes for application program memory. Creates a SuperDrive as drive C, which will be single sided, 100K. Restricts SuperDrive from using any contiguous memory which may be available above the limit set by the switch settings.

SUPERDRV C:/U=320/1/DL<ENTER>

Allocates a minimum of 320K bytes for application program memory. Creates a SuperDrive as drive C, 160K, single sided. Prevents SuperDrive from using any part of contiguous memory below the setting of the system board switches.

SUPERDRV C:/DNC<ENTER>

Allocates a minimum of 64K bytes for application program memory. Creates a double sided SuperDrive as drive C. Prevents SuperDrive from using any part of non-contiguous memory above address C0000 if available.

SUPERDRV C:/M=100/1/DL/DNC<ENTER>
SUPERDRV D:/M=20/1/DL/DNC<ENTER>

Allocates a minimum of 64K bytes for application program memory. Creates a single sided, 100K SuperDrive as drive C. Creates a single sided, 20K SuperDrive as drive D. Prevents SuperDrive from using any non-contiguous memory (if there is any available) and prevents it from using any contiguous memory available below the switch settings. This implies that there must be sufficient contiguous memory available above the switch settings to successfully perform both these commands.

SUPERDRV B:/U=384/DL/DH/1<ENTER>
SUPERDRV C:/U=384/DL/DH/1/M<ENTER>
SUPERDRV D:/U=384/DL/1<ENTER>

Allocates a minimum of 384K bytes memory for application program. Creates a standard, single sided SuperDrive as drive B, located in non-contiguous memory; physical drive B is no longer accessible. Creates a single sided SuperDrive as drive C, located in noncontiguous memory, whose size will be whatever is left over there from the previous command (around 30K when the maximum 192K was available). Creates a standard, single sided SuperDrive as drive D. Since non-contiguous memory has been exhausted from the previous two commands, drive D will be located in contiguous memory above the switch settings of the system board.

Super DRV C:/U=128

2.6 SuperDrive Application Notes

WARNING: Since any data stored in RAM (random access memory) on a SuperDrive will be lost when power is lost or the system is rebooted, only non-critical files should be stored on a SuperDrive disk drive. It is recommended that only temporary, system, and scratch files be stored on RAM disk drives. This protects you in the event of a power outage.

One of the most common and useful applications of SuperDrive uses the electronic disk to store multipart application files called "overlays". For example, if your application software is menu-driven or option-oriented, it probably consists of several different programs, each corresponding to an option. When an option is chosen, the appropriate program is loaded into RAM from disk. Thus, switching between options, menus, formats, or other logical program divisions becomes a time consuming "wait for the disk drive" experience. By copying such programs to a SuperDrive disk, the transition time between the various options becomes virtually unnoticable. It is recommended that your data files still be stored directly to a floppy disk in case of power failure. This will give you the ultimate combination of maximum speed while maintaining maximum data integrity. Word Processing programs are excellent examples of overlay software.

If you do elect to store data files on a SuperDrive, you may want to execute your application program from an AUTOEXEC.BAT file such as the one illustrated below. We suggest you add a command immediately after the call for your application program in the AUTOEXEC file which will transfer your data file(s) from the SuperDrive over to a floppy. Thus, as long as you take an orderly exit from your program back to DOS, the AUTOEXEC file will automatically take control and copy your data files to a floppy diskette. For example, let's say your program and data files are all contained on drive A, and you want to run this program on a SuperDrive as drive C, modify the data file also on drive C, exit to DOS when finished, and have your data file copied back to floppy drive A. The AUTOEXEC file on your DOS diskette in drive A might look like this:

```
ASTCLOCK        u=128
SUPERDRV C:/I
COPY A:*.* C: (copy all files from drive A to drive C)
C:
[name of application program to run from drive C]
COPY C:*.* A: (copy all files from drive C to drive A)
```

Now, when you exit your application program and return to DOS, everything on the SuperDrive disk (drive C in our example) will automatically be copied to your floppy disk in drive A.

PC DOS will not let you use a command to create SuperDrive as drive A as part of an AUTOEXEC file. However, this problem can be circumvented through some ingenuity. The following two batch files illustrate how to do this. Again, we are assuming you have two physical drives, A and B. A number of other commands have been included to illustrate what you can do with batch files. Study the SuperSpool section of this manual for understanding of the commands related to that program.

```
COPY CON: AUTOEXEC.BAT<ENTER>
ASTCLOCK<ENTER>
MODE LPTl:<ENTER>
SUPERDRV C:/l<ENTER>
SUPERSPL LPTl:<ENTER>
COPY A:*.* C:<ENTER>
C:<ENTER>
MAKE-A<ENTER>
function key F6<ENTER>
```

```
COPY CON: MAKE-A.BAT<ENTER>
SUPERDRV A:/l<ENTER>
COPY C:*.* A:<ENTER>
A:<ENTER>
[command to execute application program from drive A]<ENTER>
function key F6<ENTER>
```

At the conclusion of the above sequence, you will have two SuperDrives, drives A and C. Floppy drive A is no longer accessible; floppy drive B is still drive B. The /I option is not allowed in either command sequence. The only real drawback to creating a drive A SuperDrive in this manner is that you are using twice as much RAM as you would if creating only one drive. Note that we seem to have violated our own rules by executing commands in between the creation of the first and second SuperDrives; actually, this will work in this specific case because we did not load or execute any programs in between.

An alternative method which only creates one SuperDrive (A) is as follows:

```
COPY CON: AUTOEXEC.BAT<ENTER>
ASTCLOCK<ENTER>
MODE LPTl:<ENTER>
B:<ENTER>
MAKE-A<ENTER>
function key F6<ENTER>
```

```
COPY CON: MAKE-A.BAT<ENTER>
SUPERDRV A:/l<ENTER>
SUPERSPL LPTl:<ENTER>
COPY B:*.* A:<ENTER>
A:<ENTER>
[command to execute application program from drive A]<ENTER>
```

This method requires that the disk in drive B contain all of the programs (including MAKE-A.BAT) which you want to execute from the SuperDrive drive A. Note again that we are not permitted to use the /I parameter.

If you have only one physical drive but your system board switches are set for two or more drives for use with SuperDrive, and you wish to use the DISKCOPY command to copy a floppy disk, be sure to specify drive A as both the source and target disk. You can, of course, DISKCOPY to and from a SuperDrive if it is the same size as your physical drive A. Also, if you attempt to run the IBM diagnostics, the non-existent floppy drives indicated by the switch settings will cause errors.

If you have single sided drives, you will not be able to use the DISKCOPY command to copy double sided disks. You can, however, use double sided drives to DISKCOPY single sided disks.

To SAVE 'X' FROM [c] to [b]

D - C

R - X

D - B

N - N - B:'X'

3.0

SuperSpool

3.1 Introduction

The **SuperSpool™** program provides buffered output of print data to a parallel or serial printer while permitting concurrent processing of other programs. Files to be printed will be output to the SuperSpool buffers at maximum I/O speed, while the SuperSpool program will handle output to the printer at printer speed. SuperSpool operates in the "background" and frees the operating system for other tasks, such as the execution of another program.

3.2 SuperSpool Features

-- Provides buffered output of print data to either a parallel or serial printer

-- Simple command sequence allowing the user to specify printer ports as well as serial output baud rates and line conditions

-- Compatible with the SuperDrive electronic disk program

-- User can define the size of the spool buffer and control its location in memory

-- Allows stop/restart, previous page, line per page controls to be invoked from the keyboard

-- "Straight Wire" spool buffer does not modify print file data

-- Compatible with PC DOS

3.3 SuperSpool Command Format and Options

IMPORTANT: SuperSpool may need to use the resident portion of the DOS MODE command from time to time. Therefore, before initializing SuperSpool, issue the following MODE command (use the same command whether using a parallel or serial port):

MODE LPT1:

This command needs to be executed only once at the beginning of each computing session. If you are using both SuperDrive and SuperSpool, the above MODE command should be issued prior to SuperDrive & SuperSpool. This command may be issued whether or not your system has any parallel ports installed.

Output of data to a printer can be handled in two different ways, depending on the type of printer.

Format A, for output to a parallel printer port (LPTn):

**SUPERSPL LPTn:[/M=xxx][/U=xxx]][/P][/R]/[/RP][/S][/C][/LPP=][/B]
[/DH][/DL][/DNC]<ENTER>**

Format B, for output to a serial printer using an asynchronous serial port (COMn):

**SUPERSPL LPTn:=COMn:[/RATE=[,PARITY[,DATABITS[,STOPBITS]]]]
[/ON=][/OFF=][/M=xxx][/U=xxx]][/P][/R][/RP][/S][/C]
[/LPP=][/B][/DH][/DL][/DNC]<ENTER>**

NOTE: When using SuperSpool with a serial printer, the above command syntax replaces the equivalent DOS MODE command. Also, in the above command syntax, after redirection by SuperSpool, LPTn becomes (responds as) LPTn+1 (LPT1 becomes LPT2, etc.).

3.3.1 Specifying the Output Port

NOTE: When either a serial or parallel port is assigned (redirected) with SuperSpool, that port may not be used by any program for any purpose until the port is "released" by another SuperSpool redirection command (see section 3.8).

LPTn: Selects one of the three possible parallel ports: LPT1, LPT2, or LPT3.

LPTn:=COMn: Redirects parallel printer output to an asynchronous port. COM1 and COM2 are the only valid serial ports. LPTn now responds as LPTn+1 (LPT1 becomes LPT2, etc).

3.3.2 Serial Printer Configuration Parameters

RATE= For serial printers only. Sets the baud rate of the selected asynchronous communication adapter (110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19200 Bits Per Second).

PARITY For serial printers only. Parity is either N (none), O (odd), or E (even). Default is even.

DATABITS For serial printers only. Either 7 or 8 (default = 7).

STOPBITS For serial printers only. Either 1 or 2. If RATE=110, use 2; otherwise use 1.

/ON=option,... /OFF=option,... For serial printers only. This parameter is used to turn on and off certain serial printer port line protocol options. Output to a serial printer will only occur when all SuperSpool printer output conditions have been met. This applies to XON/XOFF, DCD, DSR, and CTS. XON/XOFF is enabled by **/ON=XON** and disabled by **/OFF=XON.**

Data set line conditions are determined by the state of the signals DCD, DSR, and CTS. All data set line conditions can be ignored by **/OFF=DCD,DSR,CTS,XON.** Any or all of these lines can be enabled by a similar **/ON=option(s)** command. The need for the use of the /ON and /OFF options is dictated by the internal configuration of your serial printer and its cabling to the PC.

The default condition of the data set line conditions is CTS and DSR ON (that is, SuperSpool must see them ON before it will output data to the printer); DCD and XON/XOFF are OFF (ignored). Consult your printer manual for information on its particular requirements in all the above serial options. The appendix of your AST User's Manual also may be of help.

3.3.3 Memory Allocation Parameters

/U=xxx This option reserves a minimum of xxxK bytes of memory for the application program and its work space. If no /U parameter is specified, SuperSpool will reserve a minimum default program space of 64K. This memory will not be used by the SuperSpool program.

The purpose of the /U parameter is to make sure that you leave enough room for your application software to execute properly. If your application software manual says the program requires 128K of memory to execute, you should use /U=128 in your command syntax. This ensures that at least 128K of RAM is available, within which your application software will reside and execute. See section 5 for more information on memory allocation.

NOTE: If you use the /U option and are also using SuperDrive, you must have used the **exact same** /U parameter with SuperDrive.

/M=xxx This option allocates xxxK bytes of memory for use as the SuperSpool print buffer. If no /M=xxx parameter is specified, the spool buffer size defaults to 64K. (Using spool buffers of less than 4K bytes is not recommended for efficient operation.)

/M This is similiar to the /M=xxx option, except that ALL remaining available memory which has not been reserved for application program space or for SuperDrive(s) will be allocated to the spool buffer. This is a powerful option in that it allows for absolutely no wasted memory space after making the other necessary memory allocations.

/DH, /DL, /DNC Please see section 2.4.2 for an explanation of these memory allocation options. The function of these options with SuperSpool is identical to that of SuperDrive. You may also want to refer to section 5.

3.3.4 Printer Formatting and Spooler Control Parameters

/LPP=xx Sets the number of lines per page (default is 66).

The following commands may be invoked from DOS while spooling is taking place to control the printer and the spool buffer output. If your printer has its own internal input buffer, some of the commands may take some time to take effect as the printer empties its own internal buffer.

/S Stop output of print data. No data will be lost and data transmission may be restarted at will using /C.

/C Restart output of print data, if previously stopped by /S.

/B This option enables the /RP and /R options below.

Comment: It is recommended that the /B option only be specified when the spool buffer is at least 16K bytes in size. Additional buffer space is used to "save" the extra page or two of print data and, in smaller buffer configurations, could consume all available spool buffer space.

/R The printer output will be restarted at the beginning of the **current** page, if enabled by the /B option.

/RP The printer output will be restarted at the beginning of the **previous** page, if enabled by the /B option.

/P Immediately purge all data from the SuperSpool print buffer.

3.4 Examples of SuperSpool Command Syntax

The examples below are provided to clarify the use of the SUPERSPL command syntax. AST recommends that you review and understand these commands before you try to use SuperSpool for the first time. In all of the following examples, it is assumed that there is sufficient memory available to successfully execute the command, and that a "MODE LPT1:" command has been executed previous to initializing SuperSpool. If there is no memory available for use by the spooler, an "INSUFFICIENT MEMORY" message will occur.

3.4.1 SuperSpool Parallel Printer Command Examples

SUPERSPL LPT1:<ENTER>

Allocates (by default since no /U parameter was used) a minimum of 64K bytes of memory for user application program. Sets up a 64K-byte (default) spool buffer for the parallel printer connected to port LPT1.

SUPERSPL LPT1:/M=16/LPP=60/B<ENTER>

Allocates (by default) a minimum of 64K bytes of memory for user application program. Sets up a 16K-byte spool buffer for the parallel printer connected to LPT1. Sets lines per page to 60. Enables subsequent use of the /R and /RP options.

SUPERSPL LPT1:/DL/M<ENTER>

Allocates a minimum of 64K bytes of memory for application program. Creates a spool buffer whose size will be whatever is available in contiguous and non-contiguous memory above the limit set by the system board switch settings (will not use any contiguous memory below the switch settings). Spools output to LPT1.

3.4.2 SuperSpool Serial Printer Command Examples

NOTE: In each of the following serial printer examples, the LPTn port being redirected to COMn becomes LPTn+1 after activating SuperSpool (LPT1 responds as LPT2; LPT2 becomes LPT3).

SUPERSPL LPT1:=COM1:/RATE=1200,N,8,1/B<ENTER>

Allocate (by default) a minimum of 64K bytes of memory for application program. Create (by default) a 64K spool buffer. Set up SuperSpool to redirect LPT1 to serial port COM1 at 1200 baud, no parity, eight databits, and one stopbit. Also, select the /B option to enable subsequent page reprint functions.

SUPERSPL LPT1:=COM2:/RATE=110,E,7,2/U=128/M=16<ENTER>

Allocate a minimum of 128K bytes of memory for the application program. Create a 16K spool buffer. Set up SuperSpool to redirect LPT1 to serial port COM1 at 110 baud, even parity, seven databits, and two stopbits. /B enables subsequent page reprint functions.

SUPERSPL LPT1:=COM1:/RATE=2400,E,7,1/ON=CTS/OFF=DCD,DSR /M=100/B<ENTER>

Allocate a minimum of 64K bytes for application program. Create a 100K-byte spool buffer. Set up SuperSpool to redirect LPT1 to serial port COM1 at 2400 baud, even parity, seven databits, one stopbit. SuperSpool will monitor the CTS (Clear to Send) signal from the serial printer and stop its output if this signal line is turned off by the printer. This feature is built into the SuperSpool program to allow high speed printers to control the flow of data from the spool buffer. DCD (Data Carrier Detect) and DSR (Data Set Ready) signals are ignored. Also, /B option is selected to enable page reprint functions.

SUPERSPL LPT1:=COM1:/RATE=300,N,8,1/ON=XON/OFF=DCD,DSR,CTS /DL<ENTER>

Allocate a minimum of 64K bytes for application program. Create a 64K spool buffer, none of which will be located in contiguous memory below the system board switch settings (via the /DL option). Set up SuperSpool to redirect LPT1 to serial port COM1 at 300 baud, no parity, eight databits, one stopbit. SuperSpool will monitor the XON/XOFF character flags sent by the printer (if your printer has this option). The data set signals DCD, DSR, and CTS are ignored.

SUPERSPL LPT1:=COM2:/RATE=2400,O,7,1/U=320/DL/DNC/M<ENTER>

Allocate a minimum of 320K bytes for application program. Create a spool buffer whose size will be whatever is available in contiguous memory above the limit set by system board switch settings, and none of which will be located below the switch settings or in non-contiguous memory. Redirect output from LPT1 to COM2 at 2400 baud, odd parity, 7 databits, 1 stopbit.

3.5 Page Reprint Control Functions

If the /B option has been selected, SuperSpool will monitor the printer output data stream for form feed (go to the top of the next page) and line feed (go to the next line) characters. (NOTE: a form feed character determines the top of page while a line feed character specifies the end of a line and may also be used, by counting the number of linefeeds per page, to determine the top of page.)

When the /R or /RP options are invoked, SuperSpool will immediately continue output at the beginning of the specified page. This can be used to restart your output at a convenient reference point (the top of the current or previous page) should the printer jam or otherwise malfunction.

Obviously, the /R and /RP options can have no meaningful effect if at least one page has not been printed.

Recommended sequence when selecting /R and /RP options:
(NOTE: /B option must be executed prior to the /R or /RP options)

1. From DOS, enter "SUPERSPL /S" command to stop printer output.

2. Adjust the printer paper to place the printer paper at the top-of-form position, etc. If the printer has a control to set the top-of-form ("TOF Set" or equivalent), use it.

3. Enter "SUPERSPL /R" or "SUPERSPL /RP" to restart printing at the current or previous page.

3.6 Determining SuperSpool Status

Once SuperSpool has been activated, status may be checked at any time by entering the appropriate SUPERSPL command. The current printer configuration and spool buffer status will be displayed for reference at the completion of any "SUPERSPL [parameter]" command operation. While spooling is going on, simply entering "SUPERSPL" from DOS will also give its status.

3.7 Changing Printer Configuration

The SuperSpool-directed printer port configuration may be changed when the spool buffer is empty. However, the memory and buffer configuration (/M or /M=xxx) options may only be modified after rebooting the computer.

3.8 Examples of Valid Subsequent SUPERSPL Commands

These are commands which the operator may issue after SuperSpool has already been brought up and is in use. Note that these commands do not deal with the size of the spool buffer or the configuration of the serial port's parameters.

SUPERSPL LPT1:=COM2:/B<ENTER>

Redirect LPT1 to serial port COM2 using all previously defined SuperSpool options and the previously defined parameters for COM1. Spool buffer must be empty when redirecting ports. Also, enable /B option for page reprint functions.

SUPERSPL /S/LPP=66<ENTER>

Stop the printing, and set lines per page equal to 66.

SUPERSPL /RP<ENTER>

Restart printing beginning from the previous page.

SUPERSPL LPT1:<ENTER> (after prior redirection to serial port)

Terminate redirection to the serial port and direct the spooler to parallel printer LPT1. Spool buffer must be empty when redirecting ports. LPT2 reverts back to being LPT1, etc.

SUPERSPL /B<ENTER>

Enable the /R and /RP print options.

SUPERSPL<ENTER>

Display SuperSpool status.

3.9 SuperSpool Utility Batch Files

SuperSpool may be invoked from an AUTOEXEC.BAT file just like ASTCLOCK and SUPERDRV. The only real restriction is that the SUPERSPL command must immediately follow those for SuperDrive, and a "MODE LPT1:" command should be invoked before everything else (necessary only once per session). Refer to the "Batch Processing" section of your DOS manual for more detailed information on batch files.

You may want to add one or more batch files to your working DOS diskette which will allow you to invoke the printer control options or display SuperSpool status automatically when you type in a short command while under DOS.

For example, the following commands create a batch file that will cause spooling of print data to your NEC serial printer at 1200 baud, even parity, seven databits, one stopbit, monitor the CTS signal, ignore the DCD and DSR signals, set up a 16K print spool buffer, and select page reprint functions. It will also allocate a minimum of 64K bytes for your application program.

COPY CON: NEC.BAT<ENTER>
SUPERSPL LPT1:=COM1:/RATE=1200,E,7,1/ON=CTS/OFF=DCD,DSR
/M=16/B<ENTER>
function key F6<ENTER>

With this file on your DOS disk, all you have to do to initialize SuperSpool for your NEC printer is type in "NEC". This batch file could itself be called from an AUTOEXEC.BAT file.

The following example illustrates how to create a batch file to stop the printing of data by SuperSpool:

COPY CON: STOP.BAT<ENTER>
SUPERSPL /S<ENTER>
function key F6<ENTER>

With this file on your default drive's diskette, you simply type STOP<ENTER> to stop SuperSpool's output to the printer.

The following batch file would cause SuperSpool to reprint, starting at the top of the previous page:

COPY CON: RP.BAT<ENTER>
SUPERSPL /S/RP<ENTER>
function key F6<ENTER>

With this file on your default drive's disk, you simply type RP<ENTER> to reprint, starting from the previous page.

3.10 Hints for SuperSpool Program Application

The SuperSpool program is designed to be transparent to PC data files. The output of data files is done via the LPTn parallel ports, or via the COMn serial ports (only after invoking the SuperSpool command to redirect the output from the parallel port to the serial port).

Once the SuperSpool program has been started, you can output data or files using DOS COPY commands or BASICA PRINT commands via the parallel port. The screen print function will also work.

Always use the SuperSpool redirect commands if you want to spool to a COMn serial port. Shortcutting with the DOS MODE command will short circuit the SuperSpool software. This does not, however, change the necessity of invoking the "MODE LPT1:" command at some point at the start of your computing session. See section 3.3 for more information.

If you are using word processing programs that have custom printer selections, you may only use their parallel printer option if you want to use SuperSpool for output. Most of these word processing programs have their own serial port handling routines and these may not be compatible with the SuperSpool program. This may also be true of any other application software which allows you to set up its output parameters.

THIS INCOMPATIBLITY IS NOT CAUSED BY A PROBLEM WITH THE SUPERSPOOL PROGRAM!

The SuperSpool software was designed to fix its own output parameters and is simply not meant to contend for output resources with another program. If you want to disable your application program's serial printer output parameters, ask the manufacturer for advice.

Certain programs, especially word processors, will not instantaneously send a large document out to a printer. These programs modify the print data "on the fly", which takes time. They will probably run faster with SuperSpool than without it, but not as fast as, for example, LLISTing a BASIC program through SuperSpool.

A simple example of one of the things you can do with SuperSpool is print a listing of a BASIC program, while running that same program on your PC. In effect, the source code is copied into the print buffer, which then releases control of the program to the operating system. Just be sure your spool buffer is large enough to contain your program listing.

If you have problems with either SuperDrive or SuperSpool when running with certain application programs, you may have to do some experimenting with the memory allocation commands, including restricting both utilities to memory available above the limit set the system board switches (by using the /DL option in your commands). You may also have to reserve very large user areas with the /U option.

4.0 SuperDrive and SuperSpool: Rules For Use

SuperDrive and SuperSpool are very powerful utility programs which can greatly enhance the capabilities of your PC. However, in order for the user to be able to successfully use these programs, certain "rules and restrictions" must be understood and observed.

4.1 General Specifications and Rules for Use

The following specifications **must** be adhered to when using SuperDrive and SuperSpool.

-- The switches inside the computer must be set for the total number of drives, including SuperDrive, just as if it were a floppy drive. For example, if you have two floppy drives and want SuperDrive to be drive C, set the switches for three drives. Refer to section 2.3 of this manual.

-- When using both programs, if the /U=xxx option is used with either program, the **exact same** /U=xxx option must be used with both programs.

-- When using both programs, the SuperDrive commands must immediately precede the SuperSpool commands. Both programs should be initialized before you run your application software.

-- If you wish to reconfigure the /U or /M parameters for either SuperDrive or SuperSpool, you must reboot the computer and start from scratch.

-- DOS will not let you create a drive A SuperDrive as part of an AUTOEXEC.BAT file. See section 2.6 for an "indirect" method of accomplishing this.

Both utilities are known to function correctly with DOS and with BASIC and BASICA. Beyond that, there are no guarantees! This is especially true for SuperSpool when used with a serial printer and with a program (such as a word processor) which has its own serial printer driver routine "built-in". In a case like this, there may be conflicts between the two programs which prevent proper operation.

Another potential area of incompatibility is with applications programs which expect to be loaded and executed out of a specific memory range. Such programs may not allow themselves to be displaced to a different address by SuperDrive and SuperSpool.

SuperDrive and SuperSpool will function correctly **only** with IBM's PC DOS. They will not work with any other operating system.

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5.0 Allocation of Memory

In order to make the most efficient use of all available memory, it is imperative that the user plan ahead of time how to allocate this memory. In order to do this, you must understand how SuperDrive and SuperSpool allocate memory for their own use, and how this affects your user programs.

Both of these utilities follow a definite set of rules when apportioning memory, both for the user's application program and for their use. These rules are summarized below.

RULE 1: When the amount of memory in the PC is the same as the limit set by the system board switches, S/D and S/S put themselves into low memory and displace the user's area upward toward the end of memory.

RULE 2: When there is more contiguous memory in the PC than the limit set by the system board switches, S/D and S/S will use the memory above the switch settings first, starting at the high end and working downward. When this memory is exhausted, S/D and S/S will begin using low memory and displace the user's area upward.

RULE 3: When there is non-contiguous memory available beginning at address C0000, as well as contiguous memory available above the limit set by the system board switches, the non-contiguous memory is used first, starting at the high end and working downward. When this is exhausted, the contiguous memory above the switch limit is used next (again, from high to low). Finally, when this is exhausted, low memory is used and the user's program area is displaced upward.

RULE 4: If <u>any</u> portion of SuperDrive or SuperSpool ends up in low memory, so will the resident portion.

The following formula may help you in deciding how you want to (or must) allocate your memory:

```
           xxxK  Total actual memory installed
Minus    - 016K  Approximate DOS memory requirement
Minus    - yyyK  Memory required by user program
Equals   = uuuK  Memory available to SuperDrive and SuperSpool
                 (aprx)
```

5.1 Examples of Memory Allocation

The diagrams which accompany the following examples are intended for illustration purposes only; the relative sizes of the memory areas are not necessarily accurately depicted.

EXAMPLE 1 - Your total system memory is 256K, which is what your system switches are set for. You have two double sided floppies. Suppose you want to run a program which uses 30K of memory for

execution and requires 100K for storing data. 100K + 30K = 130K which must be reserved for this program via the /U=xxx parameter in both SuperDrive and SuperSpool. The DOS needs about 16K for its use, so plugging the numbers into the equation, we get:

```
         256K Total actual memory installed
Minus  - 016K Approximate DOS memory requirement
Minus  - 130K Memory required by user program
Equals - 110K Memory available to SuperDrive and SuperSpool(aprx)
```

Note that you do not have enough memory to make SuperDrive a full, double sided drive. Let's say you decide to allocate 80K to SuperDrive, and that it will be drive C. Whatever memory is left after this is to be allocated to SuperSpool. The following commands will do this for you:

```
SUPERDRV C:/U=130/M=80<ENTER>
SUPERSPL LPT1:/U=130/M<ENTER>
```

These commands will work in this priority (see Rule 1):

1) Reserve 130K of memory for your application software and protect it from use by SuperDrive and SuperSpool.

2) Allocate 80K to SuperDrive (since we have not specified otherwise, it will attempt to create a double sided drive which, of course, will be short 240K [320K minus 80K]). The resident portion and buffer portion of SuperDrive will load above DOS and push the 130K user memory up above them.

3) Spool output to the parallel printer port, with /M causing SuperSpool to create a buffer whose size will be whatever amount of memory is left after the previous allocations. The resident portion and buffer portion of SuperSpool will locate immediately above SuperDrive's area; the 130K user memory is pushed up above them to utilize the last 130K in the system.

The following diagram illustrates memory allocation in Example 1:

```
    End of System Memory -->   -------------------------
  (Same as Switch 2 Settings)  |   User Memory (130K)  |
                               -------------------------
                               |  SuperSpool (Buffer)  |
                               -------------------------
                               |  SuperSpool (Program) |
                               -------------------------
                               |  SuperDrive (Buffer)  |
                               -------------------------
                               |  SuperDrive (Program) |
                               -------------------------
                               |          DOS          |
  Start of System Memory -->   -------------------------
```

EXAMPLE 2 - You have 320K installed in your system, which is what your system switches are set for. You have two single sided floppies. Your program needs 64K reserved for its use, and you want to create a standard, single sided SuperDrive (160K), inserted as drive B.

	320K	Total Memory (64K on system board and 256K expansion)
Minus	- 016K	Approximate DOS memory requirement
Minus	- 064K	Memory required by user program
Equals	= 240K	Memory available to SuperDrive and SuperSpool (aprx.)

The following commands could be used:

```
SUPERDRV B:/1/I<ENTER>
SUPERSPL LPT1:=COM1:/RATE=1200,N,8,1/M<ENTER>
```

These commands will work in this priority (following Rule 1):

1) Reserve 64K of memory for user program space (since no size was actually specified with a /U=xxx option, the default value of 64K is used);

2) Make SuperDrive a standard, single sided drive as drive B (note that you do not need to use the /M=160 option since /1 automatically allocates the 160K required for a single sided drive). What was physical drive B is now drive C (via /I). SuperDrive and its buffer reside above DOS; the 64K user area has been displaced upward to the area above SuperDrive.

3) SuperSpool uses whatever memory is remaining (via /M option) for spooling printer output to the serial port COM1. COM1 is set up for 1200 baud, no parity, 8 data bits, 1 stop bit. 64K (the default value) is reserved for the user program. SuperSpool and its buffer reside above SuperDrive, and the 64K user area has again been displaced upward, this time to the end of memory.

The following diagram illustrates memory allocation in Example 2:

```
     End of System Memory -->  -------------------------
  (Same as Switch 2 Settings)  |   User Memory (64K)   |
                               -------------------------
                               |  SuperSpool (Buffer)  |
                               -------------------------
                               |  SuperSpool (Program) |
                               -------------------------
                               |  SuperDrive (Buffer)  |
                               -------------------------
                               |  SuperDrive (Program) |
                               -------------------------
                               |          DOS          |
   Start of System Memory -->  -------------------------
```

EXAMPLE 3 - You have a total of 576K of memory installed, with your system board switches set for their maximum of 544K. You have two double sided floppies. You don't need SuperDrive this time, but you would like to use SuperSpool, and you want it to reside entirely in the memory above the switch settings so the full 544K will be available to your user program.

This is a special situation in which the equation used in examples 1 and 2 no longer applies. Since there is 32K of memory above the switch settings, this is where the SuperDrive and/or SuperSpool program will go **first** in allocating memory for their use. Through careful use of the /M=xxx option, we can restrict the programs to reside entirely in that high memory.

SUPERSPL LPT1:/M=29<ENTER>

This command will follow Rule 2. It will put both the resident portion of SuperSpool and a 29K spool buffer into high memory. Why 29K? Because you must allow room for the SuperSpool program itself (we allowed 3K in this example). We don't need /U=xxx this time since we are restricting the size and, therefore, the location of SuperSpool and its buffer.

A better, more efficient way to accomplish this would be:

SUPERSPL LPT1:/DL/M<ENTER>

SuperSpool would use every available byte of memory above the limit of the switch settings, and would be prevented from using any low memory by the /DL option.

Note that you could force both SuperDrive and SuperSpool to reside entirely above the limit of the system board switch settings. You could begin by using the /M=xxx and /DL options with SuperDrive, then use /M and /DL with SuperSpool. One way to verify that you have not inadvertantly started using low memory is to use the CHKDSK function **before and after** the SuperDrive and/or SuperSpool commands. If the memory parameters (bytes free) are not identical before and after installing your SuperDrive and/or SuperSpool buffers, you have used up some of "low" memory.

The following diagram illustrates memory allocation in Example 3:

```
        End of System Memory --> -------------------------
                                 | SuperSpool (Program) |
                                 -------------------------
                                 | SuperSpool (Buffer)  |
 System Bd. Switch 2 Setting --> -------------------------
                                 |  User Memory (528K)  |
                                 -------------------------
                                 |         DOS          |
      Start of System Memory --> -------------------------
```

EXAMPLE 4 - You have 576K total memory, and your system board switches are set at 512K (Rule 2 again applies). You have two single sided floppies. You want to create two single sided SuperDrives as drives C and D, and you need to reserve 128K for your application program. Whatever is left is to be used as a spooling buffer. The equation looks like this:

	576K	Total actual memory installed
Minus	- 016K	Approximate DOS memory requirement
Minus	- <u>128K</u>	Memory required by user program
Equals	= 432K	Memory available to SuperDrive and SuperSpool (aprx.)

This is going to work out well because there is enough memory available (in spite of switch settings) to do all the above.

```
SUPERDRV C:/1/U=128<ENTER>
SUPERDRV D:/1/U=128<ENTER>
SUPERSPL LPT1:/U=128/M<ENTER>
```

These commands will work in this priority:

1) Reserve 128K of memory (always in low memory) for your application program.

2) Create a single sided SuperDrive as drive C. The resident (program) portion will be in low memory. The 160K buffer will be created first out of whatever is remaining in high memory, and then start using low memory, pushing up the user memory area.

3) Create a single sided SuperDrive as drive D. Since the SuperDrive program code is already in memory, all that need be done is to create the buffer portion, which will locate immediately above the drive C buffer. This again pushes up the 128K user memory area.

4) The size of the SuperSpool buffer (for LPT1) will be whatever memory space is left (via /M option). The resident portion of SuperSpool will be located immediately above the drive D buffer; the spool buffer will be above the resident portion of SuperSpool; and the user memory is pushed up above everything else, to the end of memory as indicated by the switch settings.

The following diagram illustrates memory allocation in Example 4:

```
       End of System Memory --> -------------------------
                                | SuperDrive (Buffer)   |
 System Bd. Switch 2 Setting --> -------------------------
                                |  User Memory (128K)   |
                                -------------------------
                                | SuperSpool (Buffer)   |
                                -------------------------
                                | SuperSpool (Program)  |
                                -------------------------
                                | SuperDrive (Buffer)   |
                                -------------------------
                                | SuperDrive (Program)  |
                                -------------------------
                                |          DOS          |
     Start of System Memory --> -------------------------
```

EXAMPLE 5 Your PC is "maxed out" with 832K of memory installed, including 192K of non-contiguous memory located beginning at address C0000. You want to create two single sided SuperDrives, and use whatever is left for SuperSpool. But this time, you don't want to utilize any part of contiguous memory available above the limit of the switches; you want to use only non-contiguous memory, followed by low memory.

```
SUPERDRV C:/1/U=128/DH
SUPERDRV D:/1/U=128/DH
SUPERSPL LPT1:/U=128/DH/M
```

Non-contiguous memory at address C0000 will be used first, followed by low memory, with the user area ending up being displaced upward to the switch limits. Contiguous memory above the limits of the switches is not used.

The following diagram illustrates memory allocation in Example 5 (including full system memory map for reference):

```
                                   -------------------------
                                   |          ROM          |
   End of Non-Contig. Memory -->   -------------------------
                                   |  SuperDrive (Buffer)  |
 Start of Non-Contig. Memory -->   -------------------------
                                   |    Graphics Buffer    |
    End of Contiguous Memory -->   -------------------------
                                   |       NOT  USED       |
 System Board Sw. 2 Settings -->   -------------------------
                                   |   User Memory (128K)  |
                                   -------------------------
                                   |  SuperSpool (Buffer)  |
                                   -------------------------
                                   |  SuperSpool (Program) |
                                   -------------------------
                                   |  SuperDrive (Buffer)  |
                                   -------------------------
                                   |  SuperDrive (Program) |
                                   -------------------------
                                   |          DOS          |
  Start of Contiguous Memory -->   -------------------------
```

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6.0 Guide to Terminology

For an explanation of terms or concepts related to DOS functions (autoexec files, batch files, DOS commands, default drive, etc.), refer to your IBM manuals.

Application Program - The program the user is going to run after setting up SuperDrive and/or SuperSpool. This could be a word processor, general ledger, or any other software.

Buffer Portion - The data storage portion of either SuperDrive or SuperSpool, as opposed to the resident (program) portion.

Contiguous Memory - Memory in the 640K range from 00000 to 9FFFF, with no gaps. Memory below the limit set by the system board switches is referred to as "low memory"; memory above the limit set by the switches is referred to as "high memory".

Logical Disk Drive - An electronic disk drive being simulated by SuperDrive software.

Non-Contiguous Memory - Memory in the 192K range from C0000 to EFFFF. This memory is available when using the MegaPlus and MegaPak with the Split Memory Addressing function enabled.

Physical Disk Drive - A mechanical floppy disk drive.

Resident Portion - The program portion of either SuperDrive or SuperSpool, as opposed to the portion used for storing data. Also refers to the program portion of the DOS MODE command used in some situations by SuperSpool.

User Area - The area of memory set aside for the application program by SuperDrive and SuperSpool via the /U=xxx option. This area will never be less than 64K in size.

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1.0 UPDATE INFORMATION FOR ALL AST MANUALS

1.1 Expansion Card Memory and I/O Configuration

Up until the introduction of the new 256K and XT model PC, the factory configuration of the memory boundary switch settings and I/O port jumpers (serial and parallel) on AST cards did not normally have to be changed when installing a new card. However, because the new computers have different capabilities and features, some configuration changes may have to be made prior to installation. This addendum outlines the differences in using your AST card in the new computers.

1.1.1 AST Card Configuration in the Old 64K PC

When installing your AST card in the original PC with the 64K system board, there is no change to the installation instructions in your AST user's manual.

1.1.2 AST Card Configuration in the New 256K PC

The new PC with a capacity of 256K on its system board must be fully populated with 256K before the memory contained on any expansion cards can be utilized. Attempting to utilize the memory on an expansion card without first filling up the system board will result in unreliable operation of the computer. For example, in a new 256K PC with only 64K on its system board, installation of an expansion card with 64K on it (for a total of 128K) is not acceptable. This also means that the switches on your AST card must be set for 256K below it. This is true whether or not the system board is fully populated, or even if the memory section of the AST card contains no memory at all. Your AST user's manual tells you how to configure these switches in the section on additional memory boards.

The serial, parallel, and clock ports on an expansion card could still be used even if all memory chips were removed from the card. Memory chips used on AST cards and supplied in AST 64K Memory Upgrade kits (AST part number MP-ØØ9) are fully compatible with the new PC and may be used to bring its system board up to 256K.

Refer to the table below or to Section 5 in your IBM Guide to Operations manual for information on setting memory size switches in your computer. Note that this table of switch settings supercedes the information in your AST user's manual.

2372 Morse Avenue, Irvine, California 92714 (714) 540-1333

SW1 1 2 3 4 5 6 7 8
ON ON ON
OF OF OF OF OF OF

SW2 ON ON ON OF ON OF OF OF

Switch #2 on the 256K PC System Board - Not the AST Card
(Also Applies to 64K PC With New ROM for the IBM Hard Disk)

Total Memory In System	1	2	3	4	5	6	7	8
64K	ON	ON	ON	ON	ON	*	*	*
128K	ON	OFF	ON	ON	ON	*	*	*
192K	ON	ON	OFF	ON	ON	*	*	*
256K	ON	OFF	OFF	ON	ON	*	*	*
shipped 320K	ON	ON	ON	OFF	ON	*	*	*
384K	ON	OFF	ON	OFF	ON	*	*	*
448K	ON	ON	OFF	OFF	ON	*	*	*
New 512K	ON	OFF	OFF	OFF	ON	*	*	*
576K	ON	ON	ON	ON	OFF	*	*	*
640K	ON	OFF	ON	ON	OFF	*	*	*

* Do Not Alter

There is no change to the configuration instructions in your AST user's manual for the serial, parallel, and clock ports on your AST card.

1.1.3 AST Card Configuration in the XT

The XT computer comes standard with 128K and is expandable up to 256K on its system board. However, unlike the new 256K PC, the system board in the XT does **not** have to be fully populated prior to utilizing the memory on any expansion memory cards. You simply set the switch on the XT system board for the amount of memory actually present on that board. You can then install your memory expansion card on top of that. You will, of course, have to set the switches on your AST card for the proper amount of memory below it. These switch settings for the AST card are summarized in the section of your AST user's manual on additional memory boards.

For example, if there is 128K in the XT, that is what you set its switch for. You then set the switches on the AST card for 128K below it. The system will automatically see the proper total amount of memory. This can be verified by observation of the memory sizing display on the screen when you turn on the computer.

If you are installing a 512K MegaPlus on top of your existing 128K, do not enable Split Memory Addressing on the MegaPlus. The 128K on the system board plus the 512K on the MegaPlus would add up to 640K, the maximum user memory normally accessible.

With memory in the XT computer, the term "system board switch setting" refers to the actual total amount of memory installed in the computer's lower 640K address range. The memory size specified by the switch on the XT's system board pertains only to the amount of memory on that board; it has nothing to do with the

total memory installed in the system. This means that when the XT is turned on, it will automatically recognize and test all memory in the lower 640K range, independent of any switch settings.

The table below summarizes switch settings in the XT for the amount of memory on its system board (see your IBM _Guide to Operations_ for more information).

XT System Board Memory Size Switch Setting (not the AST card)

Total Memory on XT System Board	3	4
128K	OFF	ON
192K	ON	OFF
256K	OFF	OFF

When installing an AST card containing one or two serial ports in the XT computer, it will be necessary to make some changes to its configuration. The system's software will support a maximum of two serial ports. Because the XT comes with a serial port, COM1, as a standard feature, any expansion card which is installed can have only one serial port on it, and this port must be set up as COM2. If your AST card has one serial port on it, that port must be configured as COM2. If your AST card has two serial ports on it, the first port must be configured as COM2, and the second port must be disabled completely by removing the "S2" and "3S" jumpers. Please refer to Section 3 of your AST user's manual for more information on reconfiguring the serial ports.

There is no change to the configuration instructions in your AST user's manual for the parallel and clock ports on your AST card.

Narrow mounting brackets for installation of your AST card in the XT are available from your dealer.

1.1.4 IBM Expansion Chassis

If you are using the IBM Expansion Chassis, all memory cards must be installed in the main computer chassis. The correct switch settings for the amount of memory in your computer are given in the section of this addendum on the new 256K PC. They may also be found in the IBM **_BIOS Kit ROM Modules_** instruction manual. If you are using the IBM hard disk controller, the switch settings for the number of floppy drives is the same as outlined in your AST user's manual. The valid drive specifiers for SuperDrive and the IBM hard drive are summarized in the table in Section 1.2.1.

1.2 Compatibility of AST Utility Software (SuperPak Diskette)

The utility programs supplied on your SuperPak diskette will function on any version of the PC, including the XT, and all programs are compatible with both DOS 1.1 and DOS 2.Ø. The switch settings for the number of floppy drives given in your AST user's manual applies to all PCs, including the XT.

The SuperPak disk itself is a formatted disk containing only the utility programs. There is no DOS on it. It is formatted single sided, eight sectors per track, and can therefore be accessed by any PC under any version of PC DOS. Be sure to put a write protect tab on the SuperPak prior to COPYing the programs off of it. After you have COPYed the utility programs from it onto a working DOS diskette, put the SuperPak in a safe place.

1.2.1 SuperDrive and SuperSpool Utilities

Your SuperPak diskette contains versions of SuperDrive and SuperSpool which are compatible with both DOS 1.1 and DOS 2.Ø. When SuperDrive or SuperSpool are initialized, they will sense which DOS you are using and make the necessary adjustments. The changes in operation of both SuperDrive and SuperSpool from that specified in your main user's manual are summarized below.

Memory Allocation - When running SuperDrive or SuperSpool in the new 256K PC or XT, memory allocation parameters "/DH", "/DL", and "/DNC" will be ignored. When running in these computers, all memory in the lower 64ØK range should be thought of as "low memory".

SuperDrive - The disk drives being emulated by SuperDrive will contain eight sectors per track when running under DOS 1.1, and nine sectors per track when running under DOS 2.Ø. When using DOS 2.Ø, using the parameter "/8" will force SuperDrive to use eight sectors per track instead of the default of nine sectors per track. DOS 1.1 will support only eight sectors per track. It is now permissible (though not necessary) to use the DOS FORMAT command on any SuperDrive.

If using SuperDrive with IBM's hard disk system, you still must set the system switches for the total number of floppy drives and SuperDrives (do not include the hard drive in this total). The hard drive (which uses drive designation C:, D:, or E: depending on how many floppy drives are specified by switch settings) cannot be replaced by a SuperDrive and cannot be displaced to a higher designation by using SuperDrive's "/I" parameter. The following table summarizes switch settings for drive configurations in the XT ("S-Drive" means SuperDrive).

J

Switch #1 on the XT System Board (not the AST card)

Total Number of Floppy & S-Drives	XT Switch Positions 7	& 8	Possible Floppy and/or S-Drive Designations	Hard Drive Designations
1	ON	ON	A: (No S-Drive)	C: etc.
2	OFF	ON	A: B:	C: etc.
3	ON	OFF	A: B: C:	D: etc.
4	OFF	OFF	A: B: C: D:	E: etc.

SuperSpool - Other than the memory allocation noted previously, there are no changes to the operation of SuperSpool.

1.2.2 RAMCLEAR.COM Memory Initialization Utility Program

The SuperPak diskette contains a new utility program called RAMCLEAR.COM. This program can be used to initialize memory in systems which contain more memory than what the system switches are set for. For example, if your switches are set for 512K but you actually have 576K installed in your computer, or if you have any noncontiguous memory at address :C0000, you should use RAMCLEAR.COM to purge out these areas of memory prior to actually using them. By doing this, you will eliminate the possibility of generating false parity errors (Parity Check 2). Because RAMCLEAR will overwrite anything which happens to be in these areas of memory, it must be the **very first** command executed when you power up or reboot your computer.

To run RAMCLEAR, simply enter

RAMCLEAR<enter>

from the DOS prompt. RAMCLEAR can also be executed as a command in an Autoexec file, either alone or as the first of a series of commands. Just remember that if you are going to use RAMCLEAR, it must be the first command given after turning on or rebooting the computer.

RAMCLEAR.COM will have no effect on the generation of parity errors caused by hardware problems and will not alter memory below the limit set by the system board switch settings. If you are using either SuperDrive or SuperSpool, it is not necessary to use RAMCLEAR; SuperDrive and SuperSpool will automatically clear out memory for you.

AST Card E
256 + 64K

1 2 3 4 5 6 7 8
on OFF on on OF OF OF on

2.0 UPDATE INFORMATION ON COMBOPLUS AND EXPANSION MEMORY CARDS ONLY

This update applies to the ComboPlus and expansion memory cards. These changes also apply when you are installing the cards in the new 256K PC or in the XT.

2.1 The Default Configuration

The factory setting for Switch #1 (SW1) is the following:

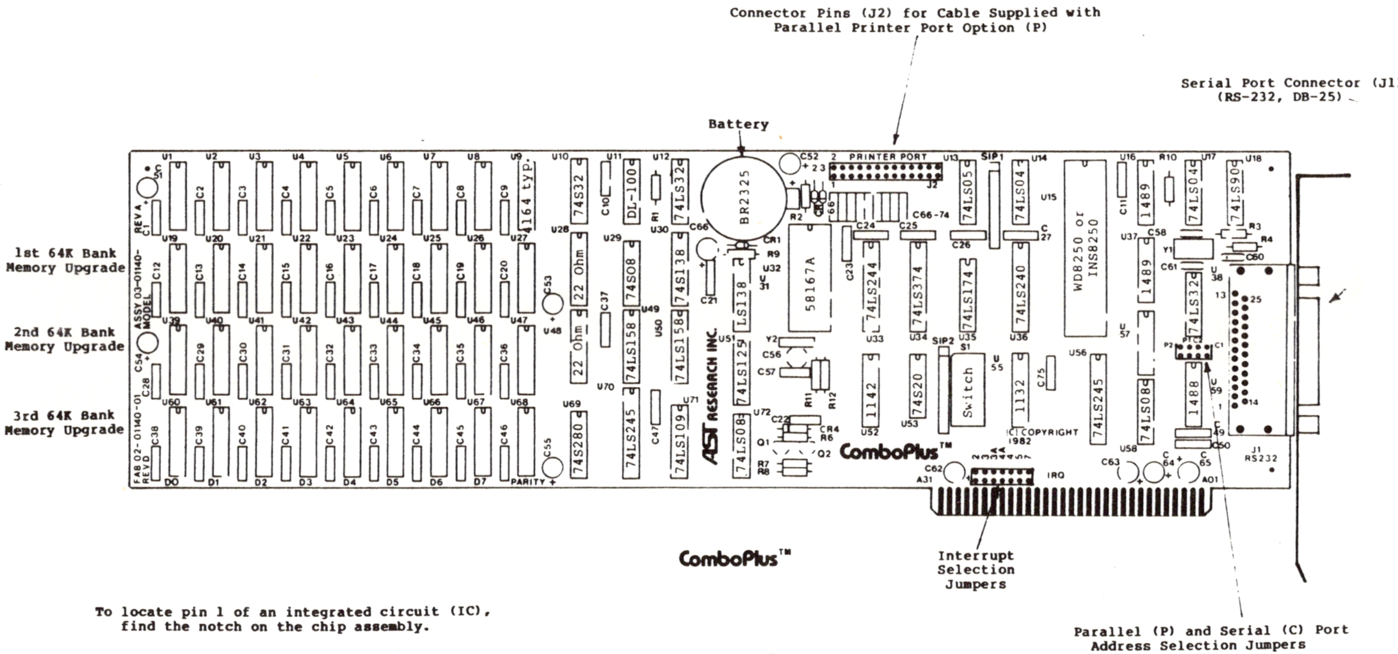
```
**********************************
*  1   2   3   4   5   6   7   8  *
*  ON  ON  ON OFF OFF OFF OFF  ON *
**********************************
```

Switch #8 is used to disable the parity check of the ComboPlus and memory expansion cards' memory. To disable the parity check, the switch position if OFF. This applies only to Revision D and subsequent revisions.

2.2 If You Have Additional Memory Boards

The table below shows the proper switch settings for the ComboPlus and memory expansion cards when other memory cards are already installed. The memory size to the left of the table is the total amount of memory onboard the PC **before** the ComboPlus or memory expansion card is installed.

		1	2	3	4	5	6	7	8		
	64K	ON	ON	ON	OFF	OFF	OFF	OFF	ON	Factory Setting	
	128K	ON	ON	OFF	ON	OFF	OFF	OFF	ON		
	192K	ON	ON	OFF	OFF	OFF	OFF	OFF	ON		
Skipped as	256K	ON	OFF	ON	ON	OFF	OFF	OFF	ON		OK
	320K	ON	OFF	ON	OFF	OFF	OFF	OFF	ON		
	384K	ON	OFF	OFF	ON	OFF	OFF	OFF	ON		
	448K	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	- 192K board	
	512K	OFF	ON	ON	ON	OFF	ON	ON	ON	- 128K board	
	576K	OFF	ON	ON	OFF	ON	ON	ON	ON	- 64K board	



To locate pin 1 of an integrated circuit (IC),
find the notch on the chip assembly.

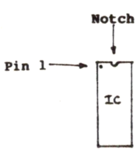


DIAGRAM A

AST RESEARCH INC.

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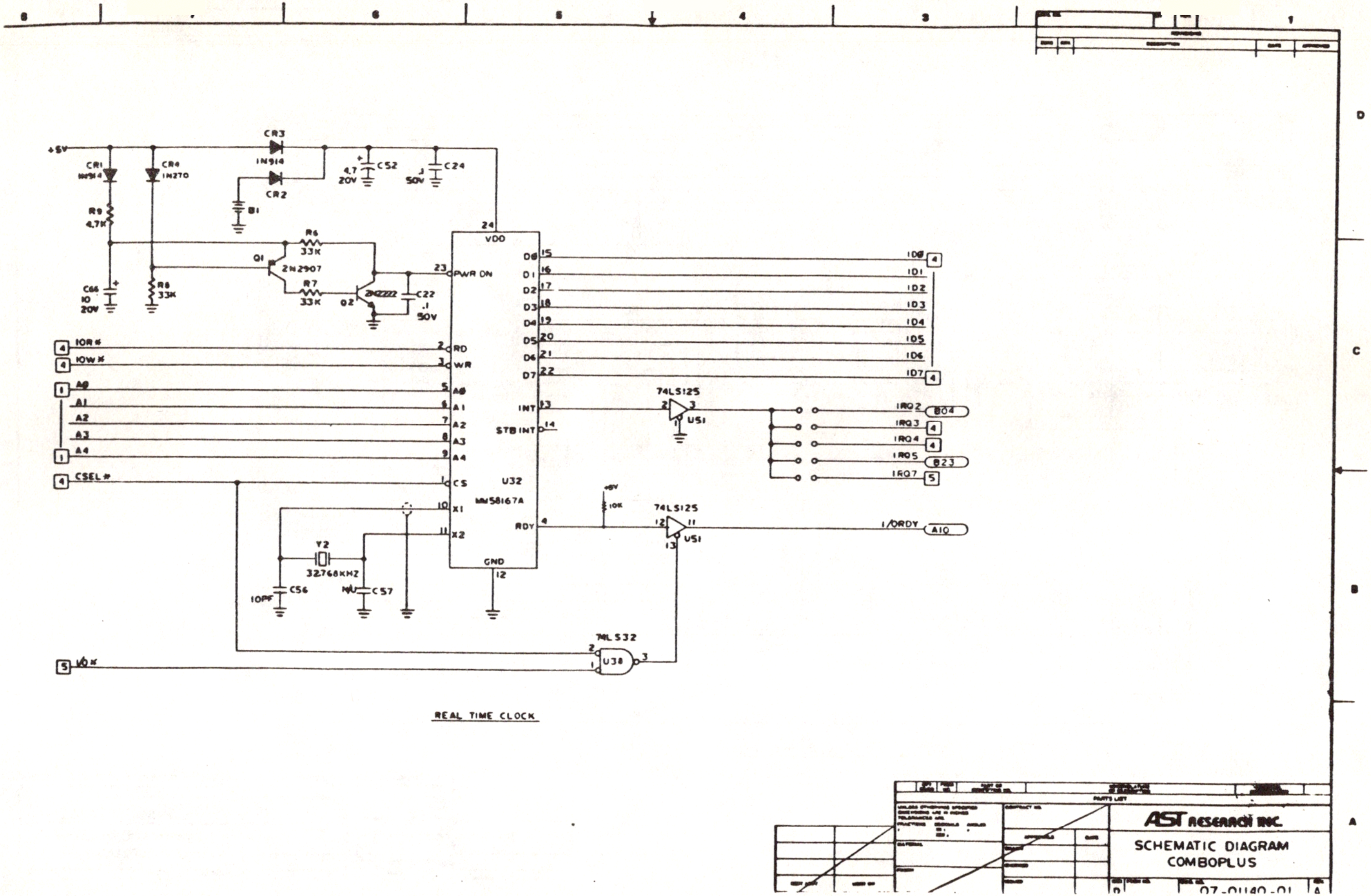
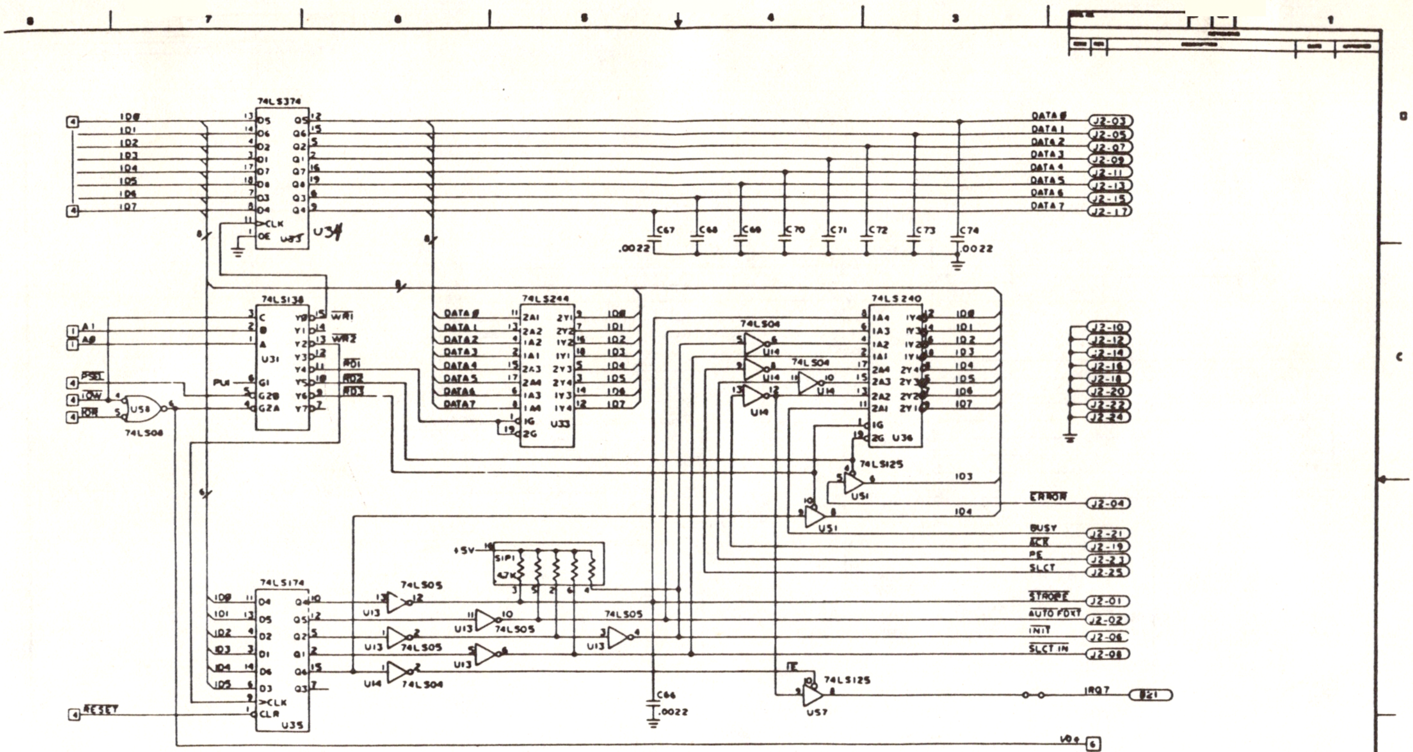


REAL TIME CLOCK

AST RESEARCH INC.

SCHEMATIC DIAGRAM
COMBOPLUS

07-0140-01

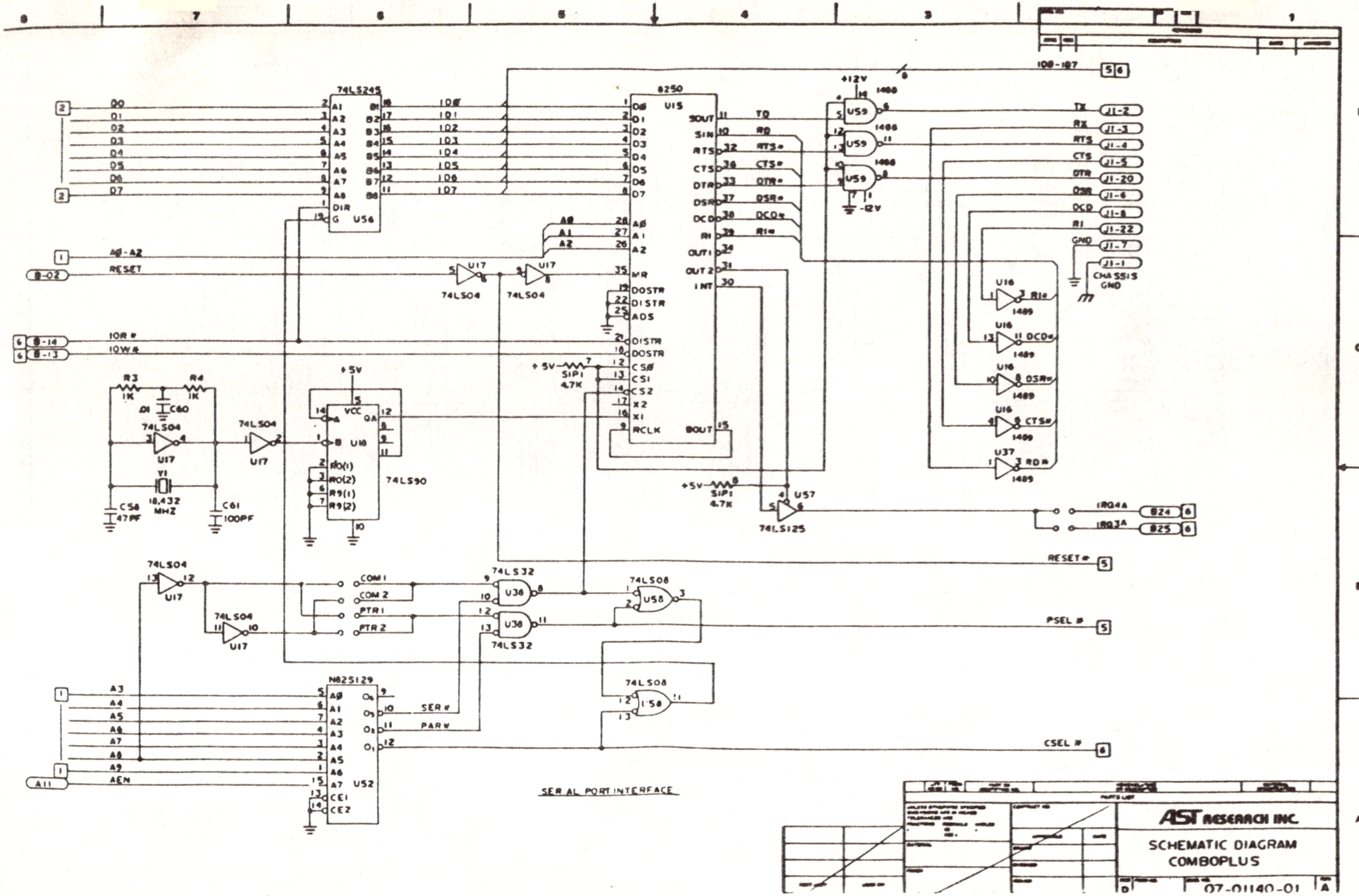


PARALLEL PORT INTERFACE

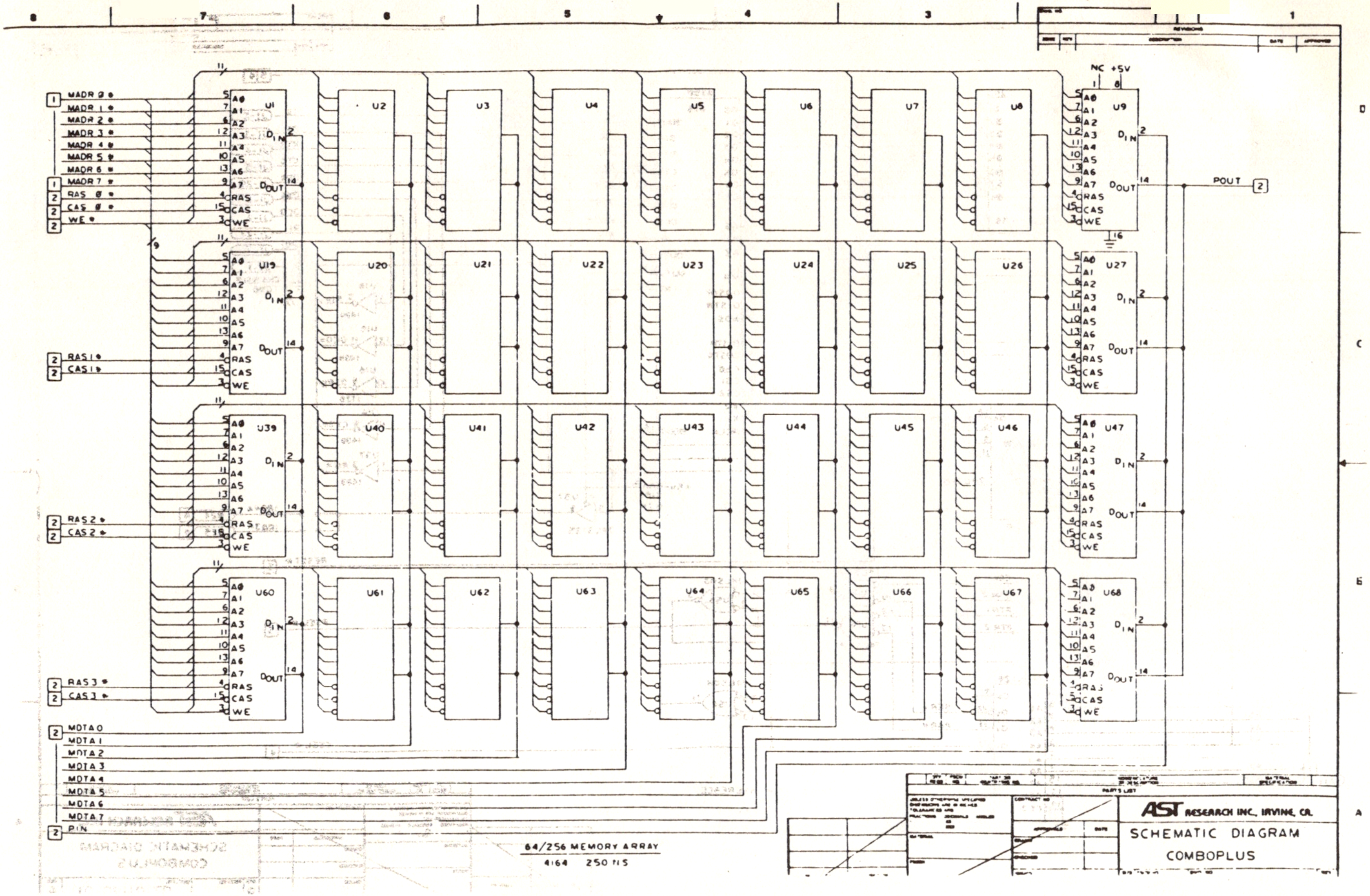
AST RESEARCH INC.

SCHEMATIC DIAGRAM

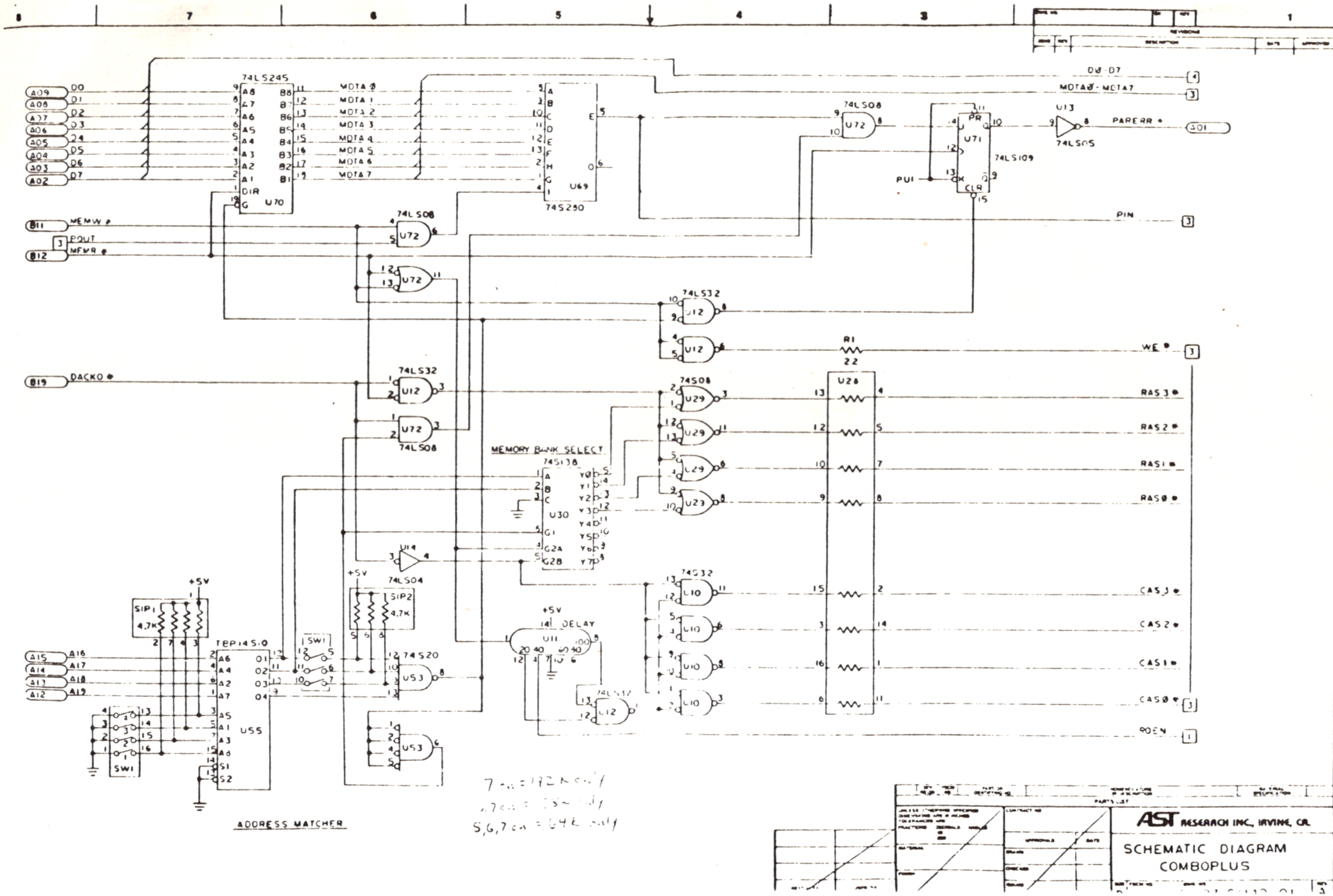
COMBOPLUS



SERIAL PORT INTERFACE
AST RESEARCH INC.
SCHEMATIC DIAGRAM
COMBOPLUS
07-01140-01



U1 U2 U3 U4 U5 U6 U7 U8 U9
U19 U20 U21 U22 U23 U24 U25 U26 U27
U39 U40 U41 U42 U43 U44 U45 U46 U47
U60 U61 U62 U63 U64 U65 U66 U67 U68
MADR Ø MADR 1 MADR 2 MADR 3 MADR 4 MADR 5 MADR 6 MADR 7
RAS Ø CAS Ø WE
RAS 1 CAS 1
RAS 2 CAS 2
RAS 3 CAS 3
MDTA 0 MDTA 1 MDTA 2 MDTA 3 MDTA 4 MDTA 5 MDTA 6 MDTA 7
PIN
POUT
NC +5V
64/256 MEMORY ARRAY
4164 250 NS
AST RESEARCH INC, IRVINE, CA.
SCHEMATIC DIAGRAM
COMBOPLUS


AST RESEARCH INC., IRVINE, CA
SCHEMATIC DIAGRAM
COMBOPLUS
ADDRESS MATCHER
MEMORY BANK SELECT
74LS245
U70
74S280
U69
74LS08
U72
74LS109
U71
U13
74LS05
PAREER *
D0-D7
MOTA0 - MOTA7
PIN
WE *
RAS3 *
RAS2 *
RAS1 *
RAS0 *
CAS3 *
CAS2 *
CAS1 *
CAS0 *
ROEN
74LS32
U12
74S08
U29
U23
74S32
U10
74S138
U30
U14
74LS04
DELAY
U11
TBP14S10
U55
74S20
U53
SIP1
SIP2
4.7K
SW1
MEMW *
MEMR *
POUT
DACK0 *
PUI
R1
22
U28
+5V

REV	DESCRIPTION	DATE
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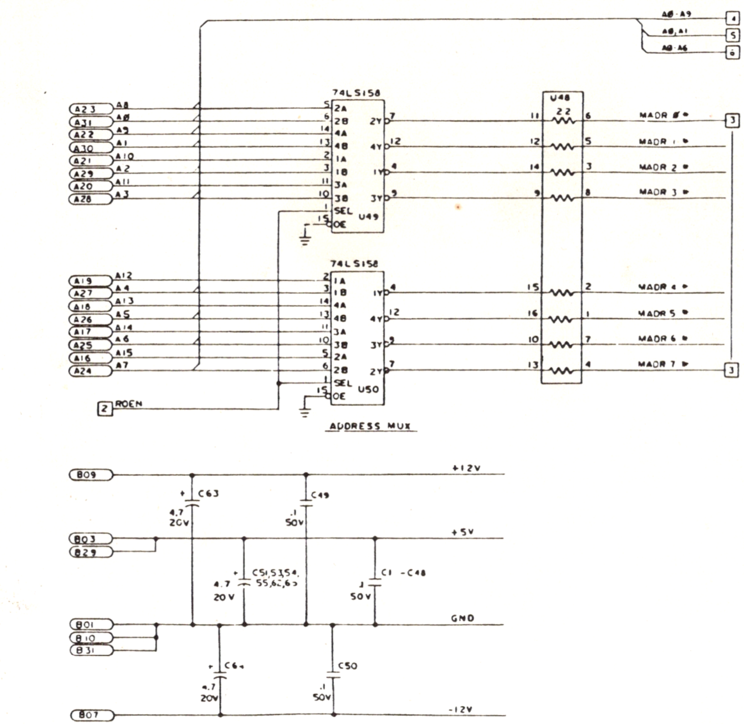

2. ALL RESISTORS ARE IN OHMS.
1. ALL CAPACITORS ARE IN MICRO-FARAD.

NOTES: UNLESS OTHEWISE SPECIFIED

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SCHEMATIC DIAGRAM
COMBOPLUS

03-01140